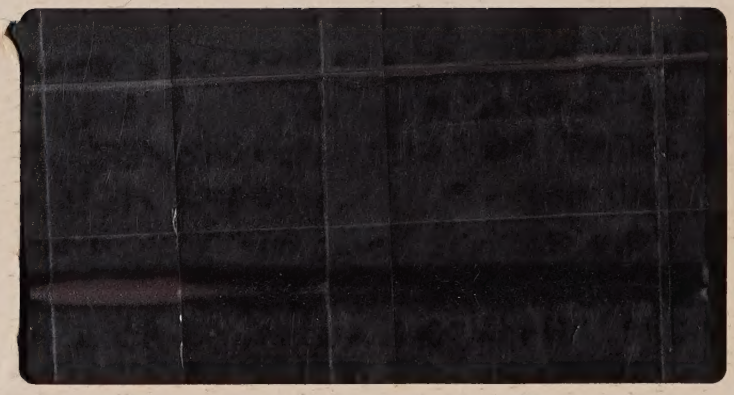
POLARAD

HANDBOOK OF OPERATING AND MAINTENANCE INSTRUCTIONS

POLARAD ELECTRONIC INSTRUMENTS,
DIVISION OF POLARAD ELECTRONICS CORPORATION
34-02 QUEENS BLVD., LONG ISLAND CITY 1, N. Y.



Tool Room Copy #1

POLARAD

INSTRUCTION MANUAL

MICROWAVE
SPECTRUM ANALYZER
MODELS
SA-84WA and SA-84WA-F

THIS HANDBOOK COVERS EQUIPMENT
PREFIXED WITH SERIAL NO. 7-1 & UP

POLARAD ELECTRONICS CORPORATION • 43-20 34th St., Long Island City 1, N. Y.

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R 7

Warranty

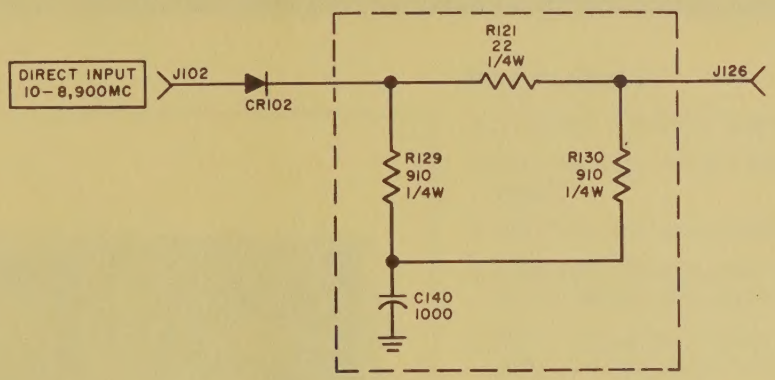
Polarad Electronics Corporation warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this Warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to making good at our factory any part or parts thereof except tubes, fuses or batteries, which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which on our examination shall disclose to our satisfaction to have been thus defective.

Polarad Electronics Corporation reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of the Polarad Electronics Corporation, and Polarad neither assumes nor authorizes any other person to assume for them any other liability in connection with the Sales of Polarad's instruments.

POLARAD
PROVEN RELIABILITY

In figure 5-1, delete connection to terminal 1 on S102E and add the circuitry included within the outline as shown below:



In Table 6-2, delete C851, C853, C854, C856, C858, R121, R129 and R130. Add the information shown below:

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C139	NOT USED			
C140	CAPACITOR, CERAMIC, 1000UUF, GMV, 500WVDC, WITH LOCKWASHER M6347 AND NUT M6369 /POLARAD PART NO. B706421	SB4A-102W	D	1
C851	SAME AS C140			
C853 AND C854	SAME AS C140			
C856	SAME AS C140			
C858	SAME AS C140			
R121	RESISTOR, COMPOSITION, 22 OHMS, 5 PCT, 1/4W	RC07GF220J	AU	1
R129 AND R130	RESISTOR, COMPOSITION, 910 OHMS, 5 PCT, 1/4W	RC07GF911J	AU	1

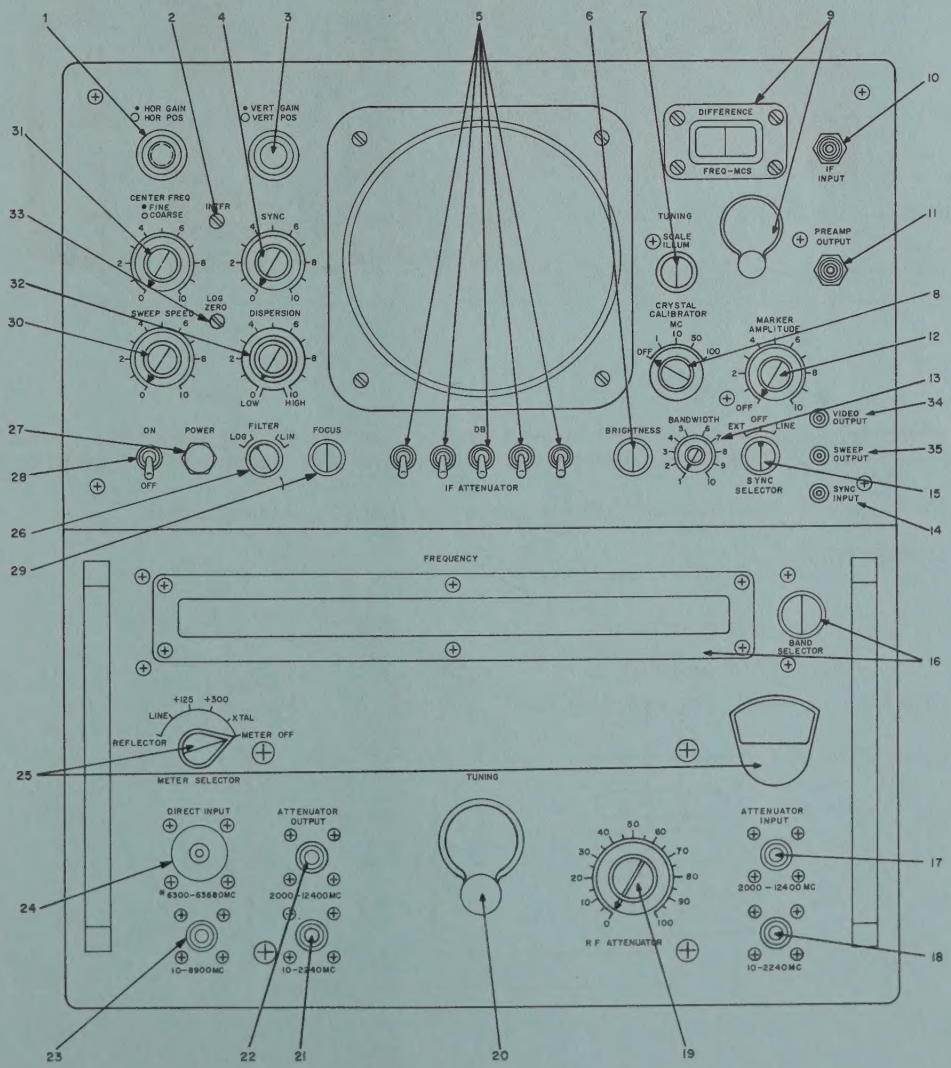
DIFFERENCE DATA SHEET
MODEL SA-84WA

Equipment changes listed below apply to serial numbers 8-1 and up only

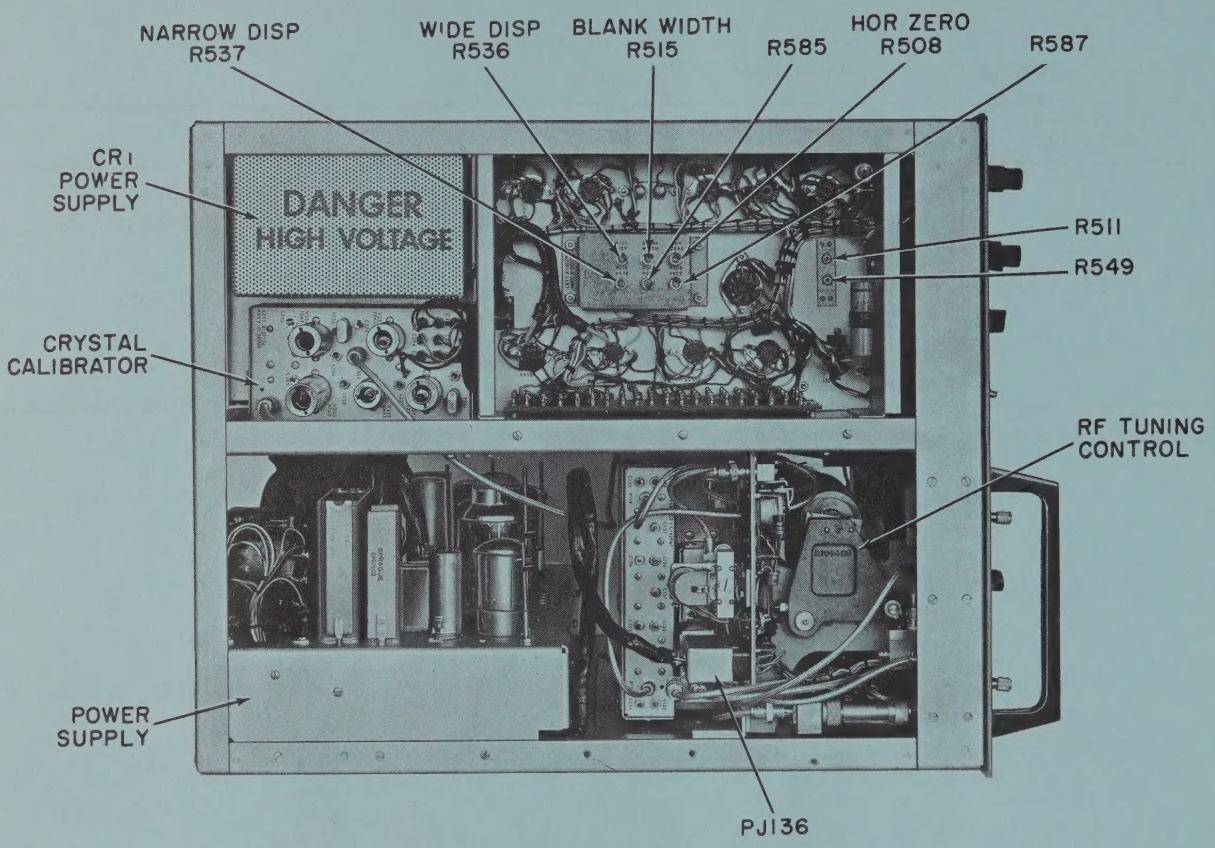
In Table 2-1, add the following information:

Figure 2-4 Index No.	Front Panel Designation	Function
33	LOG ZERO Adjustment	Adjust base-line in LOG position so that there is no base-line shift when switching from LIN to LOG.
34	VIDEO OUTPUT Connector	Provides a video signal for external use.
35	SWEEP OUTPUT Connector	Provides a sweep signal for external use.

Replace figure 2-4 with illustration below:



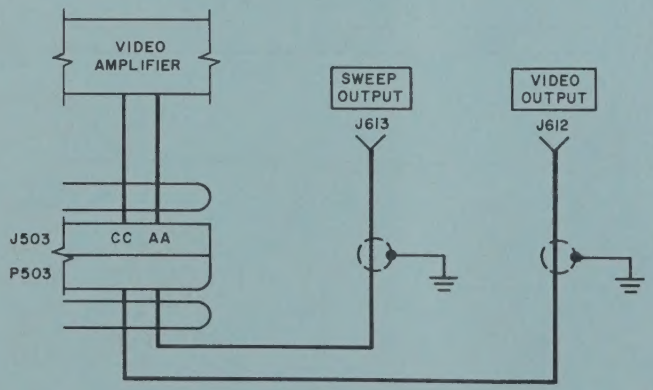
Replace figure 4-7 with photograph below:



In figure 5-2, sheet 1, change resistors R701 through R703 to inductors L721 through L723, respectively. Value of inductors L721 through L723 is 5 microhenries each. Change value of resistor R704 from "1K" to "1.8K".

Replace figure 5-2, sheet 2, with schematic which appears on following fold-out sheet.

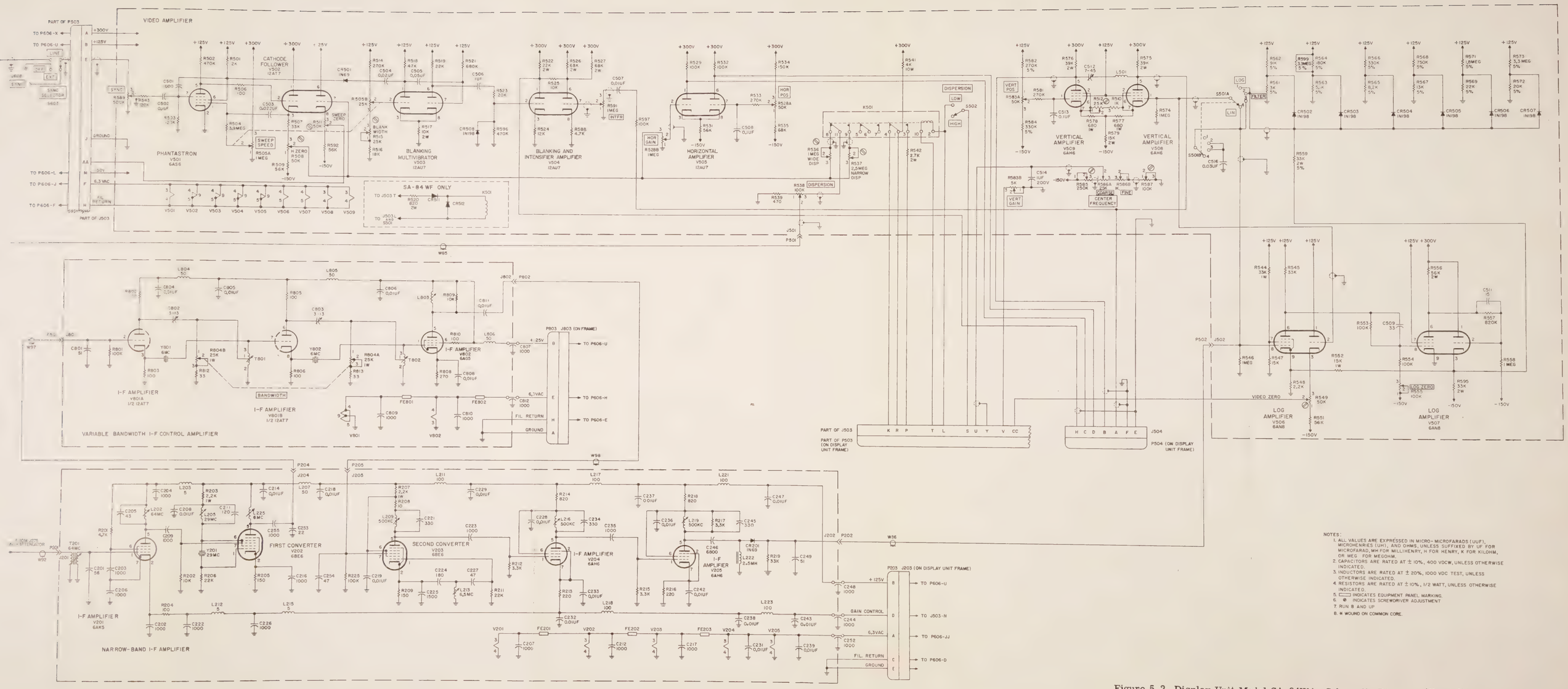
In figure 5-5 add the following:



In Table 6-2, delete J612, J613, R511, R549, R551, R555, R592, R701 through R704. Add the following information.

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
J612 AND J613	SAME AS J108			
L720	NOT USED			
L721 THRU L723	SAME AS L708			
R511	SAME AS R508			
R549	SAME AS R508			
R551	SAME AS R509			
R555	RESISTOR, VARIABLE, COMPOSITION, 100K, 10 PCT, 2W /POLARAD PART NO. 517912	RV4NAYSB104A	AU	1
R592	SAME AS R509			
R704	RESISTOR, COMPOSITION, 1.8K, 10 PCT, 1/2W	RC20GF182K	AU	1



NOTES:
1. ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF), MICROHENRIES (UH), AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.
2. CAPACITORS ARE RATED AT ± 10%, 400 VDCW, UNLESS OTHERWISE INDICATED.
3. INDUCTORS ARE RATED AT ± 20%, 1000 VDC TEST, UNLESS OTHERWISE INDICATED.
4. RESISTORS ARE RATED AT ± 10%, 1/2 WATT, UNLESS OTHERWISE INDICATED.
5. ▭ INDICATES EQUIPMENT PANEL MARKING.
6. ⊕ INDICATES SCREWDRIVER ADJUSTMENT.
7. RUN B AND UP.
8. * WOUND ON COMMON CORE.

Figure 5-2. Display Unit Model SA-84WA, Schematic Diagram (Sheet 2)

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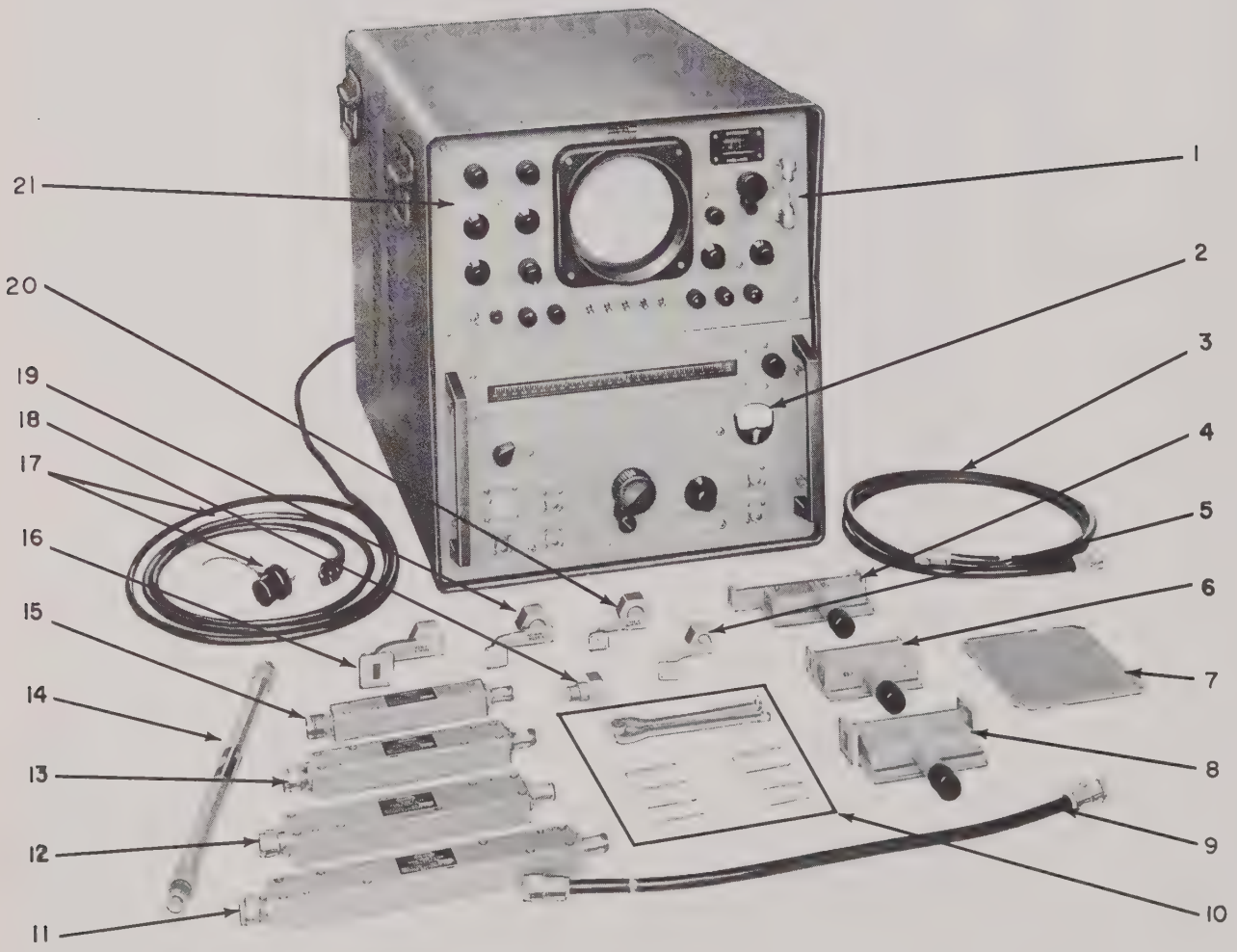


Figure 1-1. Model SA-84WA Wide Dispersion Spectrum Analyzer

SECTION I

INTRODUCTION

1-1. SCOPE OF MANUAL.

1-2. This handbook contains instructions for the Model SA-84WA Wide Dispersion Spectrum Analyzer, manufactured by Polarad Electronics Corporation, Long Island City, New York. The manual includes a general description of the equipment, operating instructions required for normal use, theory of operation, maintenance and schematic diagrams. Models SA-84WA and SA-84WAF are identical except that the model SA-84WAF is designed to operate at a power line frequency between 50 and 1000 cps. Information in this manual applies to both models unless otherwise noted.

1-3. PURPOSE AND USE OF THE EQUIPMENT.

1-4. The Model SA-84WA Wide Dispersion Spectrum Analyzer provides a rapid and accurate spectral display of the frequency distribution of energy present in r-f signals over the frequency range from 10 to 63,680 mc. The spectrum of c-w or modulated r-f signals is displayed on the cathode-ray tube screen of the SA-84WA, with the signal voltage plotted along the vertical axis and the frequency along the horizontal axis. The SA-84WA provides a choice of dispersion bandwidths for the analysis of narrow or wide pulsed r-f signals as well as variable resolution for detailing the spectrum of the signal. Specific uses of the SA-84WA are:

a. Observing and measuring the side bands associated with amplitude- and frequency-modulated r-f signals.

b. Determining the presence of radio and/or radar signals within the frequency range from 10 to 63,680 mc.

c. Determining the type of modulation of radio and/or radar signals.

d. Checking and observing the tracking of components of a radar system; i. e., tracking transmitter and receiver.

e. Checking the spectral characteristics of wide and narrow r-f pulses.

f. Measuring noise spectra.

g. Determining attenuation, insertion loss, and gain characteristics of r-f components.

h. Checking for parasitic oscillations.

i. Precise measurement of r-f signals having a relatively wide frequency separation.

j. A secondary frequency standard for the measurement of high- and low-level signal frequencies.

k. A sensitive indicator for voltage standing-wave ratio measurements.

1-5. MAJOR COMPONENTS.

1-6. The SA-84WA consists of a Display Unit, a plug-in Tuning Unit, various Cable Assemblies and accessories, as shown in figure 1-1 and listed in table 1-1.

1-7. DESCRIPTION OF THE EQUIPMENT.

1-8. The SA-84WA is a self-contained, compact unit consisting of a panel and chassis assembly which houses the Display Unit and the Tuning Unit. The Display Unit front panel occupies the upper front half of the equipment frame and serves as a mounting for the operating controls and cathode-ray tube. The bottom section of the Display Unit frame has a panel opening which is designed to accept the plug-in Tuning Unit. In operation, the Tuning Unit is inserted into the bottom portion of the Display Unit frame so that the two front panels combine to appear as a single assembly, as shown in figure 1-1.

1-9. GENERAL ELECTRICAL CHARACTERISTICS.

1-10. The general electrical characteristics and capabilities of the SA-84WA are listed below and in table 1-3.

TABLE 1-1. EQUIPMENT SUPPLIED

Fig. 1-1 Index No.	Component	Polarad Model or Part No.	Overall Dimensions (unless otherwise indicated, all dimensions are in inches)			Weight (lbs)
			Height	Width	Depth	
1	I-f Cable Assembly W80	A135336	4 in. long			
2	Tuning Unit	Model SA-84WA				See Index No. 20
3	R-f Cable Assembly W903	A109817	6 ft. long			1.0
4	**Ka Band Attenuator	AT-Ka	4	1-3/16	4-1/2	0.6
5	Waveguide Mixer Adapter		2-1/2	1-1/4	2-1/4	0.4
6	**K Band Attenuator	AT-K	4	1-3/16	4-1/2	0.6
7	Crt Filter	B27336-1				0.1
8	**Ku Band Attenuator	AT-Ku	5	1-5/16	4-1/2	0.6
9	R-f Cable Assembly W902	A109816	18 in. long			
10	*Wrench Kit	A25109				
11	**Bandpass Filter	F-6300	1-1/16	1	8-1/8	0.9
12	**Bandpass Filter	F-3550	1-3/8	1	10-1/2	1.7
13	**Bandpass Filter	F-2050	1-3/8	1	9-1/2	0.6
14	**Bandpass Filter	F-750	16 in. long x 1 in. diameter			0.7
15	**Bandpass Filter	F-1180	1-3/8	1	12-1/2	0.8
16	Waveguide (Ku Band) to Mixer Adapter		3-1/8	1-1/4	2-1/4	0.4
17	Power Cable Assembly W901 with Adapter CP901	B111144	10 ft. long			1.5

** Optional accessory. * See table 1-2. (Cont'd)

TABLE 1-1. EQUIPMENT SUPPLIED (Cont'd)

Fig. 1-1 Index No.	Component	Polarad Model or Part No.	Overall Dimensions (unless otherwise indicated, all dimensions are in inches)			Weight (lbs)
			Height	Width	Depth	
18	Type N to Mixer Adapter		1-1/4	1-1/2	1-3/16	0.4
19	Waveguide (K Band) to Mixer Adapter		3-1/4	1-1/4	2-1/4	0.4
20	Waveguide (Ka Band) to Mixer Adapter		3	1-1/4	22-1/4	0.4
21	Display Unit	Model SA-84WA	20-1/2	18-3/4	25-3/4	135 with Tuning Unit
Not Shown	**Rack Brackets					
Not Shown	**Instrument Dolly	DA-4				

** Optional Accessory

TABLE 1-2. WRENCH KIT TOOLS

Tool	Polarad Part Number
Spanner Wrench H901	AP15550
#4 Spline Wrench H902	A515101
#6 Spline Wrench H903	A515102
#8 Spline Wrench H904	A515103
#10 Spline Wrench H905	A515104
#4 Allen Wrench H906	A515301
#6 Allen Wrench H907	A515302
#8 Allen Wrench H908	A515303
#10 Allen Wrench H909	A515304

TABLE 1-3. SENSITIVITY, *INTERNAL R-F ATTENUATION, AND CONNECTOR TYPE FOR VARIOUS FREQUENCY RANGES

Frequency Range (in mc)	Sensitivity* (in -dbm)	Internal R-f Attenuation	Connector Type
10 to 640	100 to 115	0 to 100 db, variable	Type N
640 to 1,440	95 to 110	0 to 100 db, variable	Type N
1,040 to 2,240	90 to 110	0 to 100 db, variable	Type N
2,000 to 4,400	105 to 115	0 to 100 db, variable	Type N
4,200 to 8,900	100 to 115	0 to 100 db, variable	Type N
6,300 to 13,500	90 to 105	0 to 100 db, variable	Type N
12,800 to 27,200	75 to 100	None (External Attenuators Available)	
19,250 to 40,880	60 to 95		
40,000 to 63,680	45 to 85		

Frequency (in kmc)	Waveguide	Flange
12.4 to 18	RG-91/U	UG-419/U
18 to 26	RG-53/U	UG-595/U
26 to 40	RG-96/U	UG-599/U
40 to 63	WR - 19	UG-383/U

*Sensitivity is signal + noise = twice noise at minimum dispersion and resolution.

Frequency range..... 10 to 63,680 mc, covered in ten bands (seven of which are overlapping)
- Band 1 ..... 10 to 240 mc
- Band 2 ..... 240 to 640 mc
- Band 3 ..... 640 to 1,440 mc
- Band 4 ..... 1,040 to 2,240 mc
- Band 5 ..... 2,000 to 4,4000 mc
- Band 6 ..... 4,200 to 8,900 mc
- Band 7 ..... 6,300 to 13,500 mc
- Band 8 ..... 12,800 to 27,200 mc
- Band 9 ..... 19,250 to 40,880 mc
- Band 10..... 40,000 to 63,680 mc

Spectrum display..... Logarithmic or linear signal strength on the vertical axis versus frequency on the horizontal axis.

Logarithmic display..... Approximately 3 db per graticule division, over 24 db - maximum log display 36 db.

Resolution bandwidth (at the 3-db points)..... 1 to 80 kc, variable

Frequency dispersion
- 10 to 240 mc..... 25 kc with expanded H gain to 10 mc, variable
- 240 mc to 40,880 mc ..25 kc with expanded H gain to 80 mc, standard; 100 mc on special order, variable in two ranges.

Sweep speed ..... 1 to 30 cps, variable

Synchronization ..... Internal line frequency, external, or free-running.

Crystal calibrator
- 10 to 240 mc..... 1 mc, 10 mc.
- 240 to 2,240 mc ..... 50 mc.
- 2,000 to 40,880 mc... 100 mc.
- Accuracy..... ±0.01%

Variable marker range ..±40 mc.
- Accuracy ..... ±5% of maximum display.

Frequency dial accuracy
- 10 to 2,000 mc..... ±1% of the fundamental local oscillator frequency or 2 mc, whichever is greater.
- above 2,000 mc..... ±1% of dial.

I-f attenuation
- Variable..... 0 to 40 db.
- Step..... 0 to 20 db, in 1-db steps (accuracy 0.1 db per db).

Cathode-ray tube .....5-inch, P7, phosphor, flat-faced tube (edge lighting provided).

Facilities for Camera Mounting.....On CRT Bezel.

Operating temperature range .....0°C (32°F) to 50°C (122°F).

Power requirements

SA-84WA 115/230-volts (rms) AC, 50 to 60-cps, 500 watts.

SA-84WAF 115/230-volts (rms) AC, 50 to 1000-cps, 500 watts.

1-11 ELECTRON TUBE, CRYSTAL DIODE, FUSE, AND INDICATOR LAMP COMPLEMENT.

1-12. Table 1-4 lists the types and functions of the complement of electron tubes and crystal diodes used in the equipment. The types and functions of the fuses and indicator lamps used in the SA-84WA are listed in table 1-5.

TABLE 1-4. ELECTRON TUBE AND CRYSTAL DIODE COMPLEMENT

Subassembly and Reference Symbol Number	Type	Function
Tuning Unit		
V101	6BL6	Klystron (high-frequency) Local Oscillator
V102	6AF4A	Low Frequency Local Oscillator
V103	6AF4A	Low Frequency Local Oscillator
CR101	1N69	Line Voltage Rectifier
CR102	1N415E	Low frequency crystal mixer
CR103	1N26A	High frequency crystal mixer
CR104		Protective diode
Q851	2N700	
Narrow-band I-f Amplifier		
V201	6AK5	Amplifier
V202	6BE6	Converter
V203	6BE6	Converter
V204	6AH6	Amplifier
V205	6AH6	Amplifier
CR201	1N69	Video Detector
Marker Oscillator		
V301	6AF4A	Oscillator
Crystal Calibrator		
V351	12AT7	50 Mc Oscillator
V352	6AK5	Doubler
V353	5763	Amplifier
V354	12AT7	10 Mc Oscillator and Divider
V355	12AX7	Amplifier
Sweep Frequency Generator		
V403	6AQ5	Driver
V405	5718	High Dispersion Oscillator
V406	5718	High Dispersion Oscillator
V408	6AK5	Amplifier

(Cont'd)

TABLE 1-4. ELECTRON TUBE AND CRYSTAL DIODE COMPLEMENT (Cont'd)

Subassembly and Reference Symbol Number	Type	Function
Sweep Frequency Generator (cont'd)		
V409	5718	Low Dispersion Oscillator
CR402	1N82A	Mixer
Video Amplifier		
V501	6AS6	Phantastron
V502	12AT7	Cathode Follower
V503	12AU7	Blanking Multivibrator
V504	12AU7	Blanking and Intensifier Amplifier
V505	12AU7	Horizontal Amplifier
V506	6AN8	Log Amplifier
V507	6AN8	Log Amplifier
V508	6AH6	Vertical Amplifier
V509	6AH6	Vertical Amplifier
CR501	1N69	Coupling diode
CR502 through CR507	1N198	Log shaping diodes
Low Voltage Power Supply		
V601	5R4	Rectifier
V602	6AR6	Series Regulator
V603	12AX7	Control Amplifier
V604	0A2	Voltage Reference
V605	0A2	Voltage Reference
V606	0A2	Voltage Reference
V607	0B2	Voltage Reference
V608	6080	Series Regulator
V609	6080	Series Regulator
V611	6080	Series Regulator
V612	12AX7	Control Amplifier
V613	5881	Series Regulator

(Cont'd)

TABLE 1-4. ELECTRON TUBE AND CRYSTAL DIODE COMPLEMENT (Cont'd)

Subassembly and Reference Symbol Number	Type	Function
Low Voltage Power Supply (cont'd)		
V614	12AX7	Control Amplifier
V615	5651	Voltage Reference
V620	12AX7	Control Amplifier
Q601	2N277	Pass Transistor
CR601 through CR604	B707117	Rectifier
CR605 through CR608	B707117	Rectifier
CR609 through CR612	B707117	Rectifier
CR613	A27794	Rectifier
CR614	1N1341	Rectifier
CR615	1N2970A	Zener Diode
High-Voltage Power Supply		
V616	6AR6	High Voltage Supply Oscillator
V617	1Z2	High Voltage Rectifier
V618	1Z2	High Voltage Rectifier
Frame Harness Assembly		
V619	5ADP7	Cathode-Ray Tube
CR616	1N23C	Crystal Filter
Wide-Band I-f Amplifier		
V701 through V704	6922	Amplifier
Variable Bandwidth I-f Control Amplifier		
V801	12AT7	Amplifier
V802	6AG5	Amplifier

TABLE 1-5. FUSE AND INDICATOR LAMP COMPLEMENT

Subassembly and Reference Symbol Number	Type	Function
FUSES		
Low-Voltage Power Supply		
F601, F602	6.25 AMP (SLO-BLO)	Power Line Protective Fuse
F603	4 AMP (SLO-BLO)	Sweep Frequency Generator Filament Protective Fuse
F604	2 AMP	Tuner Filament Protective Fuse
INDICATOR LAMPS		
Tuning Unit		
DS101 through DS104	47	Frequency Dial Illumination Lamps
Frame Harness Assembly		
DS602	328	POWER Pilot Lamp
DS603 through DS606	47	Crt Graticule Illumination Lamps

SECTION II

OPERATION

2-1. INSPECTION.

2-2. The SA-84WA is shipped complete and is ready to use upon delivery; no permanent or special installation procedures are necessary. The instrument can be used in either laboratory or field applications. It should be unpacked upon receipt, observing the usual precautions for unpacking a delicate instrument.

WARNING

THE SA-84WA (WITH THE TUNING UNIT INSTALLED) WEIGHS 135 POUNDS. IT IS STRONGLY RECOMMENDED THAT TWO PERSONS BE EMPLOYED AT ALL TIMES IN UNPACKING, LIFTING, TRANSPORTING, AND REPACKING THE EQUIPMENT.

2-3. After unpacking the SA-84WA, inspect the interior of the equipment to ascertain that no damage has occurred during shipment. To do this, turn each of the four captive-lock fasteners (located at each corner of the rear of the dust cover) one-quarter turn counterclockwise. Slide the equipment out of the dust cover. The component parts mounted on both the Display Unit and the Tuning Unit will now be visible and accessible.

2-4. Check to make sure that all tubes are firmly seated in their sockets and that all tube shields are properly in place. Examine the inter-assembly cabling to make certain that they are securely connected to their mating receptacles.

2-5. EQUIPMENT INSTALLATION.

2-6. After inspecting the equipment, plan its installation. The Model SA-84WA is supplied mounted in a cabinet for bench or cart use, or ready for one of two types of rack mountings.

a. Figure 2-1 illustrates the Model SA-84WA installed in a cabinet.

b. Figure 2-2 illustrates the installation of a rack mounted unit with protruding panel.

c. Figure 2-3 illustrates the installation of a rack mounted unit with flush panel.

2-7. OPERATING CONTROLS, INDICATORS, AND CONNECTORS.

2-8. The operating controls, indicators, and connectors necessary for the operation of the SA-84WA are located on the Display Unit and Tuning Unit front panel assemblies, as shown in figure 2-4; their functions are described in table 2-1.

2-9. SPECTRUM ANALYZER MODEL SA-84W OPERATION.

2-10. PRELIMINARY OPERATING PROCEDURE. The procedure noted below is to be followed prior to making specific measurements with the SA-84WA.

a. Before applying power to the SA-84WA, the position of the line-voltage selector switch (115V/230V), located at the rear of the display chassis, must be checked (see figure 4-4). This requires that the chassis be removed from the cabinet. To do this, proceed as follows:

(1) Set the Model SA-84WA on a bench so that the rear of the cabinet is accessible.

(2) Turn the four cam-lock screws located on the rear of the cabinet in a clockwise direction until they are loose.

(3) Slide the display chassis out of the cabinet.

(4) Set the line-voltage selector switch to the position desired for either 115-volt or 230-volt operation. When this switch is in the 115-volt factory set position, power is applied to both primary windings of T601, T602 and T604 in parallel. When it is changed to the 230-volt position, these same windings are placed in series.

CAUTION

THE 115/230-VOLT SWITCH IS FACTORY SET FOR 115 VOLT OPERATION. DAMAGE TO THE POWER SUPPLY COMPONENTS WILL RESULT IF 230 VOLTS ARE APPLIED TO THE SA-84WA WHILE THE SWITCH IS IN THE 115-VOLT POSITION.

(5) Slide the display chassis back into the cabinet.

(6) Turn the four cam-lock screws in a clockwise direction until the chassis is locked in place.

CAUTION

USE CARE WHEN REMOVING AND REPLACING THE INSTRUMENT. DO NOT USE FORCE TO GET IT INTO OR OUT OF THE CABINET.

b. Connect a nominal 115/230 volt, 50 to 60 cps power source to the power input receptacle J601 (located at the bottom rear of the Display Unit) via Electrical Power Cable Assembly W901 and Power Cable Adapter CP901.

WARNING

APPLICATION OF POWER TO THIS EQUIPMENT RESULTS IN VERY HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OBSERVE ALL SAFETY PRECAUTIONS AT ALL TIMES.

c. Turn the power ON-OFF switch to the ON position. The POWER pilot lamp will become illuminated, indicating that line power is being applied to the primaries of the power transformers in the low-voltage power supply.

d. Set the BAND SELECTOR switch so that the BAND 5 2.0 TO 4.4 KMC scale appears in the FREQUENCY dial window. Allow a fifteen minute warm-up period for the high-frequency local oscillator (located in the Tuning Unit) to stabilize.

e. Connect I-f Cable Assembly W80 as a jumper between the PREAMP OUTPUT jack and the I-F INPUT jack.

f. Adjust the HOR GAIN, HOR POS, FOCUS, and BRIGHTNESS controls to obtain a sharp base line on the crt screen.

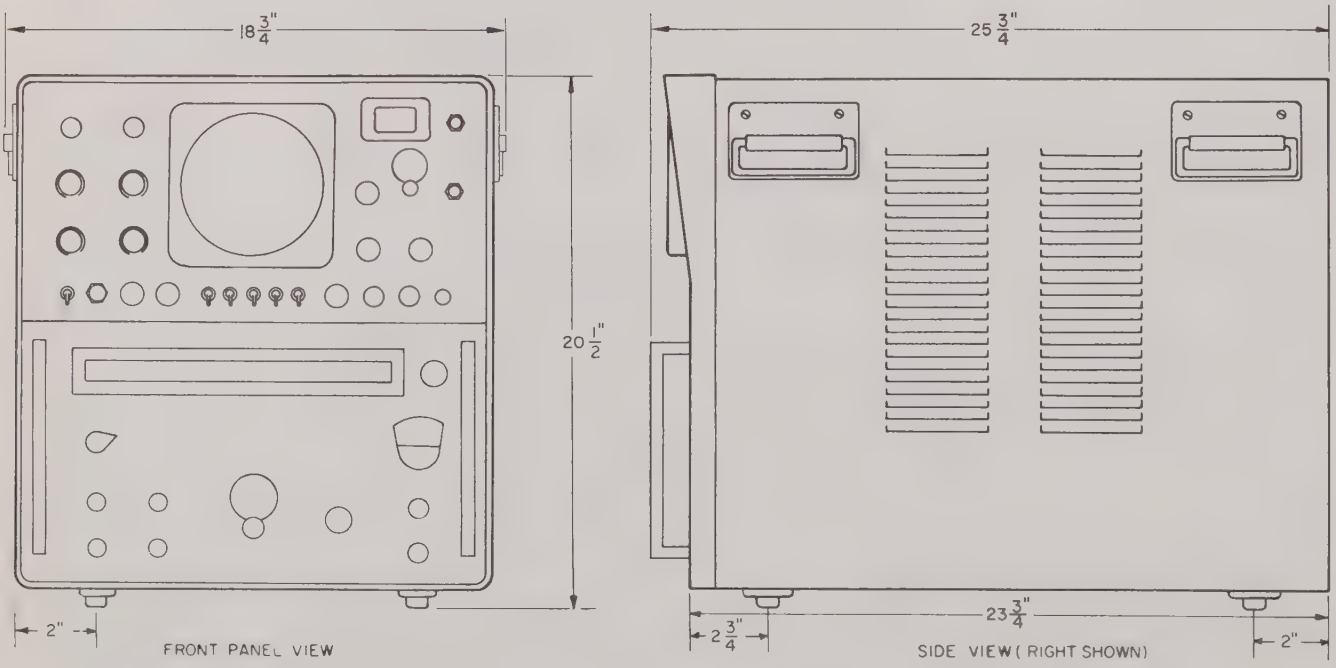


Figure 2-1. Outline Installation Drawing, Cabinet Mounted Unit

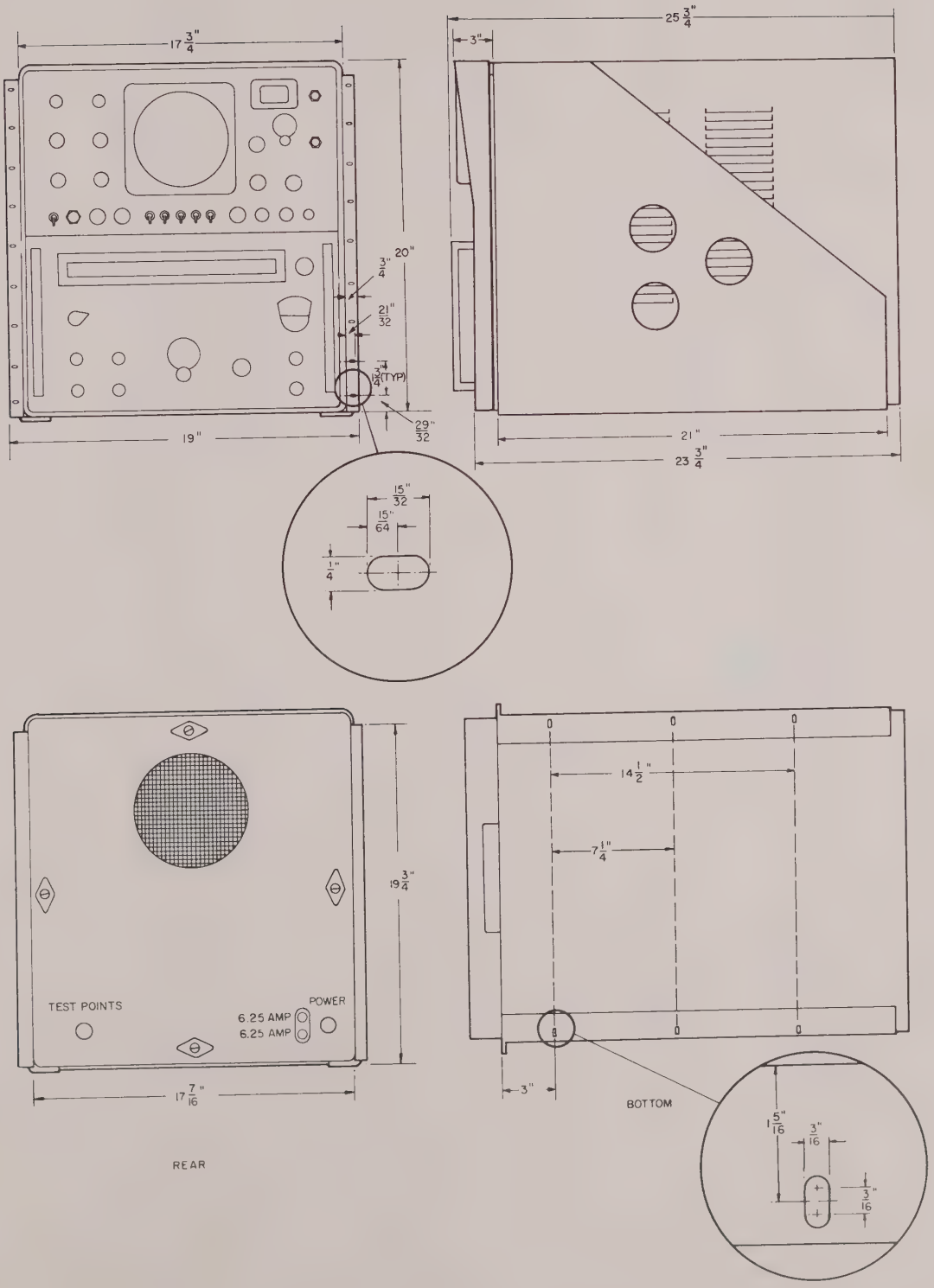


Figure 2-2. Outline Installation Drawing, Protruding-Panel Rack Mounted Unit

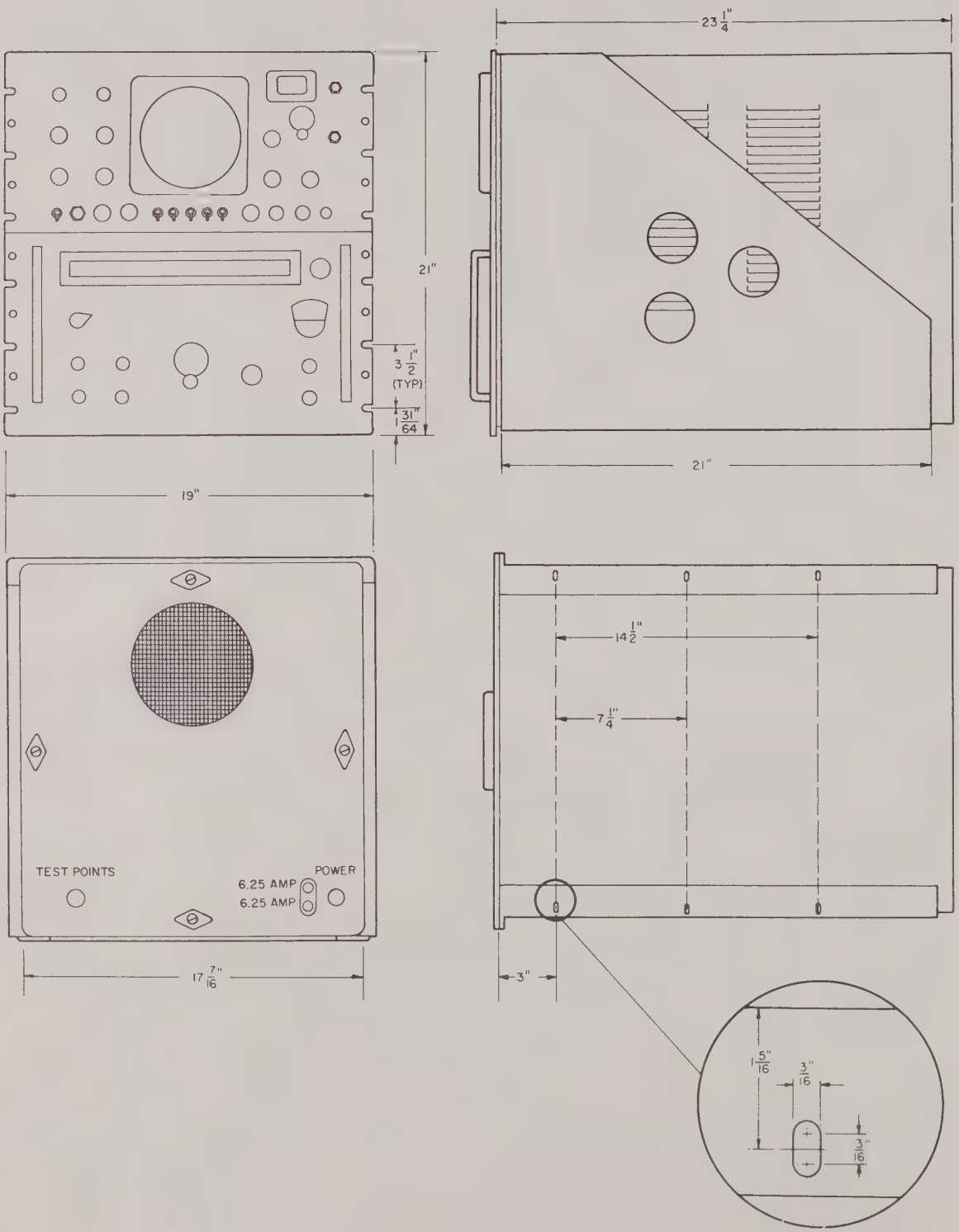


Figure 2-3. Outline Installation Drawing, Flush-Panel Rack Mounted Unit

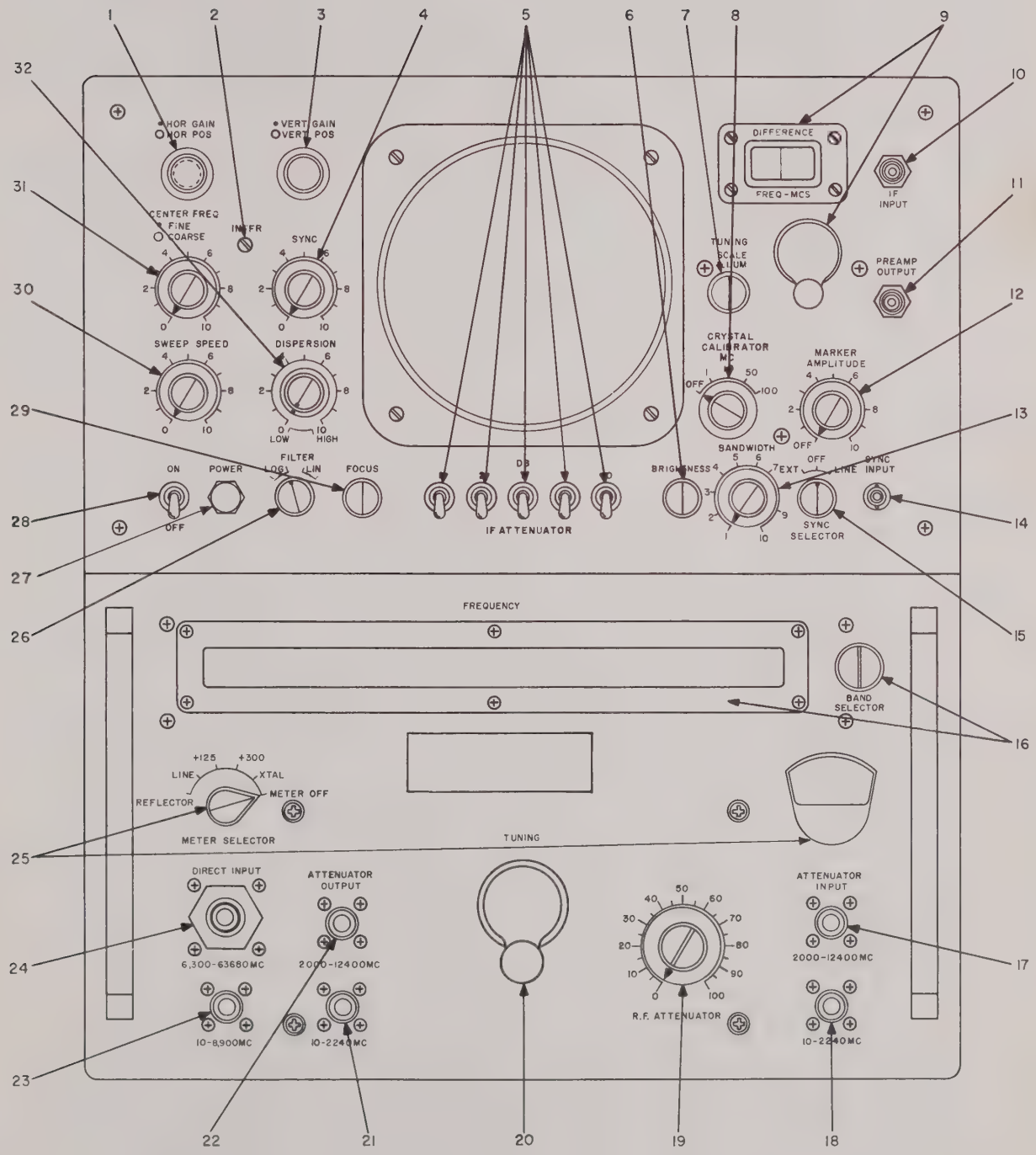


Figure 2-4. SA-84WA Front Panel Operating Controls, Indicators, and Connectors

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Figure 2-1 Index No.	Front Panel Designation	Function
1	HOR GAIN control and HOR POS control	The HOR GAIN control permits the varying of the width of the horizontal display on the crt. The HOR POS control permits the display on the crt to be shifted either to the left or to the right.
2	INTFR control	Permits the adjustment of the intensity of the signal portion of the display only.
3	VERT POS control and VERT GAIN control	The POS control permits the display on the crt to be shifted either up or down. The GAIN control permits the adjustment of the height of the vertical display on the crt.
4	SYNC control	Permits the adjustment of the synchronizing voltage, permitting the phantastron generator to lock at sub-multiples of the line frequency.
5	I-F ATTENUATOR DB switches	Permits attenuation of the vertical display in 1-db steps from 0 to 20 db.
6	BRIGHTNESS control	Varies the brightness of the trace on the cathode-ray tube.
7	SCALE ILLUM control	Controls the illumination of the crt graticule.
8	CRYSTAL CALIBRATOR MC switch	Permits the selection of either the 1, 10, 50, or 100 mc calibration pips.
9	DIFFERENCE FREQUENCY MCS TUNING control and FREQUENCY DIFF-MCS dial	Rotation of the DIFFERENCE FREQUENCY MCS TUNING control permits the location of the marker pip within ±40 mc of the i-f bandpass center frequency. Variation from the i-f bandpass center frequency is indicated on the FREQUENCY DIFFERENCE MCS dial.
10	I-F INPUT jack	Provided for applying either the output of the Preamplifier or an external test signal to the Display Unit circuitry.
11	PREAMP OUTPUT jack	Provided for access to the output of the Preamplifier. It also permits the use of the Polarad Model SD-1 Multipulse Spectrum Selector, which makes it possible for the SA-84WA to analyze individual pulses in a pulse group.
12	MARKER AMPLITUDE control	This control, when rotated clockwise beyond its OFF position, permits the adjustment of the height of the marker pip on the crt.
13	BANDWIDTH control	Permits the varying of the resolution bandwidth from 1 to 80 kc.
14	SYNC INPUT jack	Provided for the application of an external synchronizing (signal with the SYNC SELECTOR switch in the EXT position) to the phantastron generator.
15	SYNC SELECTOR switch	Permits the selection of either internal or external synchronization of the phantastron generator. When in the OFF position, the phantastron generator is free-running.
16	BAND SELECTOR switch and FREQUENCY dial	Selects the proper scale on the Frequency dial drum and indicates the frequency being measured.
17	ATTENUATOR INPUT 2000-12, 400 MC jack	Provided for the application of high-level incoming r-f signals (greater than -20 dbm).

(Cont'd)

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS (Cont'd)

Figure 2-1 Index No.	Front Panel Designation	Function
18	ATTENUATOR INPUT 10-2240 MC jack	Provided for the application of high-level incoming r-f signals (greater than -20 dbm).
19	RF ATTENUATOR control	Permits the attenuation of incoming r-f signals which are applied to either the ATTENUATOR INPUT 10-2240 MC jack or the ATTENUATOR INPUT 2000-12, 400 MC jack. The attenuation inserted by this control is variable between 0 and 100 db.
20	TUNING control	Adjusts the frequency of the signal displayed on the crt.
21	ATTENUATOR OUTPUT 10-2240 MC jack	Provided to couple the output of the r-f attenuator to the DIRECT INPUT 10 - 8, 900 MC jack.
22	ATTENUATOR OUTPUT 2000-12, 400 MC jack	Provided to couple the output of the r-f attenuator to the DIRECT INPUT 6, 300 - 63, 680 MC jack.
23	DIRECT INPUT 10 - 8, 900 MC jack	Provided for the direct application of incoming r-f signals. This connection utilizes the maximum sensitivity of the SA-84WA.
24	DIRECT INPUT 6, 300 to 63, 680 MC jack	This coaxial jack is provided for the application of incoming r-f signals. This connection utilizes the maximum sensitivity of the SA-84WA.
25	METER SELECTOR switch and Power Monitor meter	This six-position rotary switch, in conjunction with the monitor meter, monitors the various operating voltages and the first crystal mixer current as follows: a. REFLECTOR position - monitors the high-frequency local oscillator reflector voltage. b. LINE position - monitors the power line voltage. c. +125 position - monitors the +125 volt supply. d. +300 position - monitors the +300 volt supply. e. XTAL position - monitors the first crystal mixer current. f. METER OFF position - the monitor meter is not connected into the circuit.
26	LOG-FILTER-LIN switch	Permits the selection of logarithmic, logarithmic-filter, linear-filter or linear vertical deflection on the cathode-ray tube. The filter positions introduce a video filter in the circuitry.
27	POWER pilot lamp	Indicates that the SA-84WA is energized.
28	Power ON-OFF switch	Energizes the SA-84WA.
29	FOCUS control	Adjusts the sharpness of the crt display.
30	SWEEP SPEED control	Permits the control of the sweep repetition rate, which can be varied from 1 to 30 cps.
31	CENTER FREQUENCY COARSE and FINE controls	Permit adjustment of the center frequency of the sweep-frequency generator to position the display at the electrical center of the crt.

(Cont'd)

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS (Cont'd)

Figure 2-1 Index No.	Front Panel Designation	Function
32	DISPERSION HIGH-LOW switch and DISPERSION CONTROL	The switch selects the dispersion range. Note When the BAND SELECTOR switch is in the Band 1 position, the dispersion is limited to 10 mc. The control permits the adjustment of the display dispersion (amount of frequency displayed) as follows: a. When the DISPERSION switch is in the LOW position, the dispersion can be adjusted from 25 kc to 10 mc. b. When the DISPERSION switch is in the HIGH position, the dispersion can be adjusted from 1 to 80 mc.

g. Adjust the VERT POS control to locate the base line on the crt screen directly below the lowest horizontal line etched on the crt graticule.

h. Set the DISPERSION switch to the HIGH position.

i. Rotate the DISPERSION control fully clockwise.

j. Flip all the I-F ATTENUATOR DB toggle switches down, removing all i-f attenuation from the system.

k. Set LOG-FILTER-LIN switch in LIN position.

l. Rotate BANDWIDTH control maximum clockwise.

m. Rotate the VERT GAIN control to obtain approximately one-eighth inch of noise on the crt screen.

n. Rotate the MARKER AMPLITUDE control clockwise, beyond its OFF position.

o. Rotate the FREQUENCY DIFFERENCE MCS TUNING control to line up the 0 mark (inscribed on the DIFFERENCE FREQ-MCS dial) directly below the index hairline. This operation places the marker pip at the electrical center of the display.

p. Rotate the CENTER FREQUENCY control to position the marker pip at the physical center of the crt display.

q. Set the SYNC SELECTOR switch to the OFF position.

r. Set the SWEEP SPEED control to 8.

s. Rotate the MARKER AMPLITUDE control to set the height of the marker pip at approximately three inches.

t. Rotate the TUNING control to position the hairline index on the FREQUENCY dial scale at the low end of the band.

u. Connect the output jack of a microwave signal generator, such as the Polarad Model MSG-2A or MSG-2R, to the DIRECT INPUT 10 - 8,900 MC jack, via R-f Cable Assembly W903.

v. Set the microwave signal generator for a c-w output of -50 dbm at a frequency of 3.0 kmc.

w. Rotate the TUNING control until a pip representing the incoming r-f signal appears on the CRT screen. The signal will enter the display from the right. If the display is excessively large, insert i-f attenuation by flipping the I-F ATTENUATOR DB toggle switches and/or vary the VERT GAIN control to set the height of the pip at a convenient level. (Use the VERT GAIN control as a final adjustment.)

x. Continue rotating the TUNING control until the pip representing the incoming r-f signal coincides with the marker pip. When this occurs, the hairline index on the FREQUENCY dial scale should be directly above the 3.0 KMC mark (±1%).

y. The preceding step completes the operating checks.

2-11. DETERMINING THE FREQUENCY OF AN APPLIED R-F SIGNAL. After connecting operating power to the SA-84WA, proceed as follows:

a. Connect I-f Cable Assembly W80 as a jumper between the PREAMP OUTPUT jack and the I-F INPUT jack.

b. Adjust the HOR GAIN, HOR POS, FOCUS, and BRIGHTNESS controls to obtain a sharp base line on the crt screen.

c. Adjust the VERT POS control to locate the baseline on the crt screen directly below the horizontal line etched with vertical marks on the crt graticule.

d. Set the DISPERSION switch to the HIGH position.

e. Rotate the DISPERSION control fully clockwise.

f. Flip all the I-F ATTENUATOR DB toggle switches down, removing all i-f attenuation from the system.

g. Set the LOG-FILTER-LIN switch in LIN position.

h. Rotate BANDWIDTH control maximum clockwise.

i. Rotate the VERT GAIN control to obtain approximately one-eighth inch of noise on the crt screen.

j. Rotate the MARKER AMPLITUDE control clockwise, beyond its OFF position.

k. Rotate the FREQUENCY DIFFERENCE MCS TUNING control to line up the 0 mark (inscribed on the DIFFERENCE FREQ-MCS dial) directly below the index hairline. This operation places the marker pip at the electrical center of the display.

l. Rotate the CENTER FREQUENCY control to position the marker pip at the physical center of the CRT display.

m. Set the SYNC SELECTOR switch to the OFF position.

n. Set the SWEEP SPEED control to 8.

o. Rotate the MARKER AMPLITUDE control to set the height of the marker pip at approximately three inches.

p. For signals having a power level known to be less than -20 dbm, apply the signal to the applicable DIRECT INPUT jack. For signals having an amplitude known to more than -20 dbm, apply the signal to the applicable ATTENUATOR INPUT jack or to one of the external variable attenuators available from Polarad Electronics Corporation.

q. Set the BAND SELECTOR switch so that the 10 TO 240 MC scale appears in the FREQUENCY dial window. Allow a fifteen minute warm-up period for the low-frequency oscillator (located in the Tuning Unit) to stabilize.

r. Rotate the TUNING control to position the hairline index on the FREQUENCY dial scale at the low end of the band.

s. Rotate the TUNING control until a pip representing the incoming r-f signal appears on the crt screen. The signal will enter the display from the right. If the display is excessively large, vary the RF ATTENUATOR control, the I-F ATTENUATOR DB switches, and/or the VERT GAIN control to set the height of the pip to a convenient level. (Use the VERT GAIN control as a final adjustment.) Continue rotating the TUNING control until the pip representing the incoming r-f signal coincides with the marker pip. When this occurs, the hairline index on the FREQUENCY dial scale will be directly above the mark indicating the frequency of the incoming r-f signal.

Note

When the TUNING dial is rotated so that the FREQUENCY dial hairline index moves from left to right (upscale) and the pip representing the signal enters the display from the right (moving from right to left) the true signal pip has been selected. No further search of the spectrum is required. If, however, the signal pip enters the display from the left (moving from left to right) as the TUNING control is rotated so that the FREQUENCY dial hairline index moves from left to right (upscale), this is an indication that an image signal has been under observation.

t. In the event that no signal appears on the crt display when the 10 TO 240 MC scale appears in the FREQUENCY dial window, set the BAND SELECTOR switch so that the next higher scale appears in the FREQUENCY dial window, then repeat steps q and r. Continue doing this until the incoming r-f signal is observed on the CRT display.

2-12. HARMONIC RELATIONSHIP OF SIGNALS. To explain the need for searching the spectrum, consider the analysis of a signal having a frequency within the range from 640 to 2, 240 mc. Low-frequency local oscillator V102 is employed to heterodyne with the incoming signal. This oscillator operates on its fundamental frequency when tuning over band 2; on its second harmonic frequency when tuning over band 3; and on its fourth harmonic frequency when tuning over band 4. A brief explanation follows:

a. In order to check whether or not the correct band is being utilized, shift the signal under analysis 80 Mc on the crt screen. If this shows a movement of 80 Mc on the frequency dial, the correct band has been chosen. If the dial indicates less than 80 Mc, a higher frequency band must be selected. If the dial indicates a movement greater than 80 Mc, the band selector should be switched to one of a lower frequency.

2-13. MEASUREMENT OF RELATIVE R-F POWER. The relative r-f power difference between two signal sources may be measured in the following manner: Assume that two signal pips appear on the crt display, separated by not more than 80 Mc. In this example, the larger signal pip is termed "A" and the smaller "B."

a. Position the LOG-FILTER-LIN switch to LIN.

(1) Observe the position of the smaller signal, pip B. Mark its location on the crt graticule and note its height. For example, pip B reaches a height of 1 cm.

(2) Rotate the TUNING control to position the second signal, pip A, to the mark that located pip B. Note the height of pip A. For example, pip A reaches a height of 3.5 cm.

(3) Refer to the voltage ratio to decibels conversion table (table 2-2), which shows that, for a voltage ratio of 3.5 to 1, signal pip A is approximately 10.9 db greater than signal pip B. The relative difference, in db, of the two signals can also be found by use of the following formula:

$$\text{Relative difference (in db)} = 20 \log_{10} \frac{\text{Height of signal pip A}}{\text{Height of signal pip B}}$$

$$= 20 \log_{10} \frac{3.5 \text{ cm}}{1 \text{ cm}} = 20 \log_{10} 3.5$$

$$= 20 \times 0.544 = 10.88$$

b. Position the LOG-FILTER-LIN switch to LOG.

(1) Observe the position of the smaller signal, pip B. Mark its location on the crt graticule and note its height.

(2) Rotate the TUNING control to position the second signal, pip A, to the mark that located pip B. Note the height of pip A.

(3) The difference in height between pips A and B, in graticule divisions, multiplied by 3, is the relative difference of signal amplitude, in db.

2-14. USING THE VOLTAGE RATIO TO DB CONVERSION TABLE. The relation of voltage ratio to db can be determined rapidly by referring to table 2-2 and using the following procedure:

a. Convert the ratio of signal heights to a number consisting of units, tenths, and hundredths.

b. Locate the number obtained in step a above, (or the number closest to it), in the body of table 2-2.

c. Read the db value of the signal height ratio in the following manner:

(1) Note the whole number appearing in the +DB (if the signal height ratio is greater than one) or -DB (if the signal height ratio is less than one) column found at the left or right, respectively, of table 2-2, corresponding to the row in which the ratio appears.

(2) Note the decimal portion appearing at the head of table 2-2 which corresponds to the column in which the voltage ratio appears.

(3) Add the two values obtained in steps 1 and 2, above. This is the db ratio of the signal amplitudes.

Example: If the signal height ratio is 3.5, locate the value 3.51 (the number closest to 3.5) in the main body of the table. The number in the +DB column corresponding to this is 10. Next, locate the decimal portion by locating the head of the column in which the ratio appears, or 0.9. Adding these two numbers, the db ratio of +10.9 is obtained.

2-15. MEASUREMENT OF ABSOLUTE POWER. To determine the absolute power level of a signal that is under observation, proceed as outlined in paragraph 2-11 (Determining the Frequency of an Applied R-F Signal). Then proceed as directed in the following steps:

a. Rotate the FREQUENCY DIFFERENCE MCS control to position the marker pip beside the pip representing the incoming r-f signal.

b. If the pip representing the incoming signal fluctuates in amplitude, adjust the MARKER AMPLITUDE control so that the marker pip height corresponds to the maximum amplitude of the signal pip.

c. Remove the incoming r-f signal from the SA-84WA input jack.

Note

Be careful to avoid disturbing the settings of all the controls on the front panel of the SA-84WA.

d. Apply the same type of signal from a calibrated signal generator to the same input jack. Tune the generator to position the pip representing its output signal where the unknown signal was (beside the marker pip).

e. Adjust the power level control of the signal generator to obtain a signal pip which has the same height as the marker pip appearing on the crt screen. The absolute power level of the signal being analyzed may now be determined by reading the power setting of the signal generator.

Note

If the original signal under observation was applied to the SA-84WA through an attenuator (either internal or external), the amount of attenuation must be taken into account and added to the reading of the signal generator power setting.

TABLE 2-2. RELATION OF VOLTAGE RATIO TO DB*

+DB	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	-DB
0....	1.00 1.00	1.01 .989	1.02 .977	1.04 .966	1.05 .955	1.06 .944	1.07 .933	1.08 .923	1.10 .912	1.11 .902	 0
1....	1.12 .891	1.14 .881	1.15 .871	1.16 .861	1.18 .851	1.19 .841	1.20 .832	1.22 .822	1.23 .813	1.25 .804	 1
2....	1.26 .794	1.27 .785	1.29 .776	1.30 .767	1.32 .759	1.33 .750	1.35 .741	1.37 .733	1.38 .724	1.40 .716	 2
3....	1.41 .708	1.43 .700	1.45 .692	1.46 .684	1.48 .676	1.50 .668	1.51 .661	1.53 .653	1.55 .646	1.57 .638	 3
4....	1.58 .631	1.60 .624	1.62 .617	1.64 .610	1.66 .603	1.68 .596	1.70 .589	1.72 .582	1.74 .575	1.76 .569	 4
5....	1.78 .562	1.80 .556	1.82 .550	1.84 .543	1.86 .537	1.88 .531	1.91 .525	1.93 .519	1.95 .513	1.97 .507	 5
6....	2.00 .501	2.02 .495	2.04 .490	2.07 .484	2.09 .479	2.11 .473	2.14 .468	2.16 .462	2.19 .457	2.21 .452	 6
7....	2.24 .447	2.26 .442	2.29 .437	2.32 .432	2.34 .427	2.37 .422	2.40 .417	2.43 .412	2.46 .407	2.48 .403	 7
8....	2.51 .398	2.54 .394	2.57 .389	2.60 .385	2.63 .380	2.66 .376	2.69 .372	2.72 .367	2.75 .363	2.79 .359	 8
9....	2.82 .355	2.85 .351	2.88 .347	2.92 .343	2.95 .339	2.99 .335	3.02 .331	3.05 .327	3.09 .324	3.13 .320	 9
10....	3.16 .316	3.20 .313	3.24 .309	3.27 .305	3.31 .302	3.35 .298	3.39 .295	3.43 .292	3.47 .288	3.51 .285	10
11....	3.55 .282	3.59 .279	3.63 .275	3.67 .272	3.72 .269	3.76 .266	3.80 .263	3.85 .260	3.89 .257	3.94 .254	11
12....	3.98 .251	4.03 .248	4.07 .245	4.12 .243	4.17 .240	4.22 .237	4.27 .234	4.32 .232	4.37 .229	4.42 .226	12
13....	4.47 .224	4.52 .221	4.57 .219	4.62 .216	4.68 .214	4.73 .211	4.79 .209	4.84 .207	4.90 .204	4.95 .202	13
14....	5.01 .200	5.07 .197	5.13 .195	5.19 .193	5.25 .191	5.31 .188	5.37 .186	5.43 .184	5.50 .182	5.56 .180	14
15....	5.62 .178	5.69 .176	5.75 .174	5.82 .172	5.89 .170	5.96 .168	6.03 .166	6.10 .164	6.17 .162	6.24 .160	15
16....	6.31 .158	6.38 .157	6.46 .155	6.53 .153	6.61 .151	6.68 .150	6.76 .148	6.84 .146	6.92 .145	7.00 .143	16
17....	7.08 .141	7.16 .140	7.24 .138	7.33 .136	7.41 .135	7.50 .133	7.59 .132	7.67 .130	7.76 .129	7.85 .127	17
18....	7.94 .126	8.04 .124	8.13 .123	8.22 .122	8.32 .120	8.41 .119	8.51 .117	8.61 .116	8.71 .115	8.81 .114	18
19....	8.91 .112	9.02 .111	9.12 .110	9.23 .108	9.33 .107	9.44 .106	9.55 .105	9.66 .104	9.77 .102	9.89 .101	19
20....	10.0 .100										20

* Refer to paragraph 2-14 for an explanation of the use of the above table.

2-16. DETERMINING THE WIDTH OF ANY LOBE OF A SIGNAL SPECTRUM. To determine the width of any lobe of a signal spectrum, proceed as outlined below:

a. Connect operating power to the SA-84WA (see paragraph 2-10).

b. Connect I-f Cable Assembly W80 as a jumper between the PREAMP OUTPUT jack and the IF INPUT jack.

c. Adjust the HOR GAIN, HOR POS, FOCUS, and BRIGHTNESS controls to obtain a sharp base line on the CRT screen.

d. Adjust the VERT POS control to locate the base line on the CRT screen directly below the horizontal line etched with vertical marks on the CRT graticule.

e. Set the DISPERSION switch to the HIGH position.

f. Rotate the DISPERSION control fully clockwise.

g. Rotate the VERT GAIN control to obtain approximately one-eighth inch of noise on the CRT screen.

h. Flip all the I-F ATTENUATION DB toggle switches down, removing all i-f attenuation from the system.

i. Rotate the MARKER AMPLITUDE control clockwise, beyond its OFF position.

j. Rotate the FREQUENCY DIFFERENCE MCS TUNING control to line up the 0 mark (inscribed on the DIFFERENCE FREQ-MCS dial) directly below the index hairline.

k. Rotate the CENTER FREQUENCY control to position the marker pip at the physical center of the CRT screen.

l. Set the SYNC SELECTOR switch to the OFF position.

m. Set the SWEEP SPEED control to 8.

n. Rotate the MARKER AMPLITUDE control to set the height of the marker pip at approximately three inches.

o. For signals having an amplitude known to be less than -20 dbm, apply the signal to the applicable DIRECT INPUT jack. For signals having an amplitude known to be more than -20 dbm, apply the signal to applicable ATTENUATOR INPUT jack or to one of the external variable attenuators available from Polarad Electronics Corporation.

p. Set the BAND SELECTOR switch so that the spectrum under observation appears on the crt screen.

q. Rotate the TUNING control to locate the marker pip at the center of the spectrum lobe under observation.

r. Rotate the FREQUENCY DIFFERENCE MCS TUNING control so that the marker pip coincides with one edge of the spectrum lobe under observation.

s. Note the reading on the DIFFERENCE FREQ-MCS dial.

t. Rotate the FREQUENCY DIFFERENCE MCS TUNING control so that the marker pip coincides with the other edge of the spectrum lobe.

u. Note the reading on the DIFFERENCE FREQ-MCS dial.

v. Calculate the difference, in megacycles, between the readings obtained in steps s and u above. This figure is the width, in megacycles, of the particular lobe appearing in the crt display.

2-17. FINE FREQUENCY MEASUREMENT. If more than one signal is to be examined on the crt screen, the internal marker circuit may be used to determine the frequency difference between the two signals. This marker circuit is independent of the TUNING control and may be used to "set" the position on the crt screen of one signal while tuning to the second. If the signals are close in frequency, and both are seen on the crt screen, the marker pip may be moved by means of the FREQUENCY DIFFERENCE MCS TUNING control. This control accurately determines small frequency differences, where the TUNING control is too coarse an adjustment. If two frequencies are very close together, as in multi-frequency transmitters, the frequency relationship can be carefully checked. The DISPERSION control and DISPERSION switch vary the dispersion of the display so that, at maximum dispersion, 80 Mc appears across the crt screen and, at minimum dispersion, 25 kc are displayed. The minimum setting of the BANDWIDTH control makes it possible to use the SA-84WA to its minimum resolution of 1 kc. Two signals can be thus distinguished if their frequency difference is 1 kc or more.

2-18. MEASURING FREQUENCY DRIFT. The marker pip and the FREQUENCY DIFFERENCE MCS TUNING control provide a method to determine frequency drift of any piece of equipment operating within the tuning range of the SA-84WA. Set the marker pip so that it coincides with the signal under observation at the beginning of the test. The position of the DIFFERENCE FREQ-MCS dial is noted. At the end of the test, if the drift of the signal has been small, the marker pip may be moved to the new position of the signal on the crt screen. The difference between the original and new readings of the DIFFERENCE FREQ-MCS dial equals the actual drift of the signal under test. Generally, the period drift is not of as much interest as "frequency pulling," due to tighter coupling or changing load conditions. Again,

the same "before and after" procedure may be used, with the FREQUENCY DIFFERENCE MCS TUNING control now serving to determine the exact degree of "frequency pulling." The crystal calibrator may be used as a reference for small frequency drift.

2-19. CHECKING FOR CONTINUOUS TRANSMITTER OUTPUT. The visual display of the SA-84WA makes it useful in checking for "holes" in transmitter or signal generator operation. Often, using conventional test methods, low output or discontinuous operation over a small frequency range is not noticed. However, by tuning the equipment under test through its range, and tracking with the single TUNING control on the SA-84WA, the wide dispersion is used to permit careful examination of the entire spectrum.

2-20. REPRESENTATIVE SPECTRA. Figure 2-5 illustrates various types of spectra that may be observed on the crt screen of the SA-84WA. These types of "pictures" may be observed when checking the spectrum of pulsed magnetron oscillators. The display will indicate the pulse width, pulse shape, and the amount of amplitude or frequency modulation on the pulse. In this way, the SA-84WA may be used to determine the extent and type of modulation present in what should be a c-w signal or a pulsed signal. The data presented in figure 2-5 may be summarized as follows:

a. Amplitude modulation tends to change the position of the null points.

b. Frequency modulation tends to raise the null points.

c. A combination of amplitude and frequency modulation tends to distort the symmetry of the spectrum.

d. Having established the presence of distortion in the spectrum, measurements can be made to determine the nature of the modulating pulse. Side bands associated with amplitude and frequency modulated signals may be observed and measured. The relative power between side lobes and the main lobes may be determined with a calibrated r-f attenuator. Also, the half-power points of the main lobe can be determined with a calibrated r-f attenuator by noting the signal amplitude on the screen before and after 3-db of attenuation is inserted.

2-21. MEASURING INCIDENTAL F-M OF AN APPLIED SIGNAL. To measure the incidental f-m of a signal, refer to figure 2-6 and proceed as follows:

a. Apply the signal to the appropriate input jack of the SA-84WA and adjust the front panel controls so that the main lobe appears on the crt screen.

b. Adjust the VERT GAIN control so that the main lobe occupies three-quarters of the crt display.

c. Use the FREQUENCY DIFFERENCE MCS TUNING control to calibrate the bandwidth from one edge of the crt graticule to the other. Divide this bandwidth figure by 10 to find the frequency change by graticule division.

d. Rotate the SWEEP SPEED control fully counterclockwise.

e. Draw two lines to indicate the pulse envelope (see lines A and B of figure 2-6). Draw a horizontal line (C) from one side of the envelope to the other. Drop two vertical lines (D and E) to the base line from the points on the inner and outer edges of the envelope crossed by the horizontal line (C).

f. Count the number of divisions between lines D and E at the base. Use the frequency change per scale division, obtained in step c, above, to calculate the frequency change. This frequency change represents the incidental f-m of both the applied signal and that inherent within the SA-84WA.

g. Measure the inherent incidental f-m of the SA-84WA by means of the crystal calibrator. Subtract this from the total frequency change calculated in step f. The above procedure determines the incidental f-m measurement of the applied signal.

2-22. PROPER USE OF BANDWIDTH CONTROL. Resolution, the ability to separate individual signals, is dependent upon both the rate of frequency sweep and the bandwidth of the i-f amplifier. When comparing two c-w signals separated by a small frequency difference, rotate the BANDWIDTH control in a counterclockwise direction until the two signals are completely separated. If the two signals are so close that the BANDWIDTH control cannot separate them, a beat signal will be observed on the cathode-ray tube screen. This may be virtually eliminated by turning the LOG-FILTER-LIN switch to the applicable FILTER position. This introduces a video filter designed expressly for the removal of beat signals. For optimum resolution of a single or of widely separated c-w signals, the BANDWIDTH control should be rotated counterclockwise until the amplitude of the signal starts to decrease. The sensitivity of the spectrum analyzer is dependent upon the dispersion, i-f bandwidth, and sweep speed.

2-23. When displaying a pulse spectrum, the sensitivity of the spectrum analyzer is dependent only upon the bandwidth. The sweep speed should be adjusted so that approximately 50 prf lines appear in the main lobe and the first side lobe on either side of the main lobe. For optimum resolution of the pulse spectrum, the product of i-f bandwidth and pulse width must be less than 0.1. If the bandwidth is greater than this value, the minima of the spectrum is no longer zero. This loss of sensitivity due to bandwidth and pulse width reduces the dynamic range of the spectrum analyzer for pulse-modulated signals. See figure 2-7.

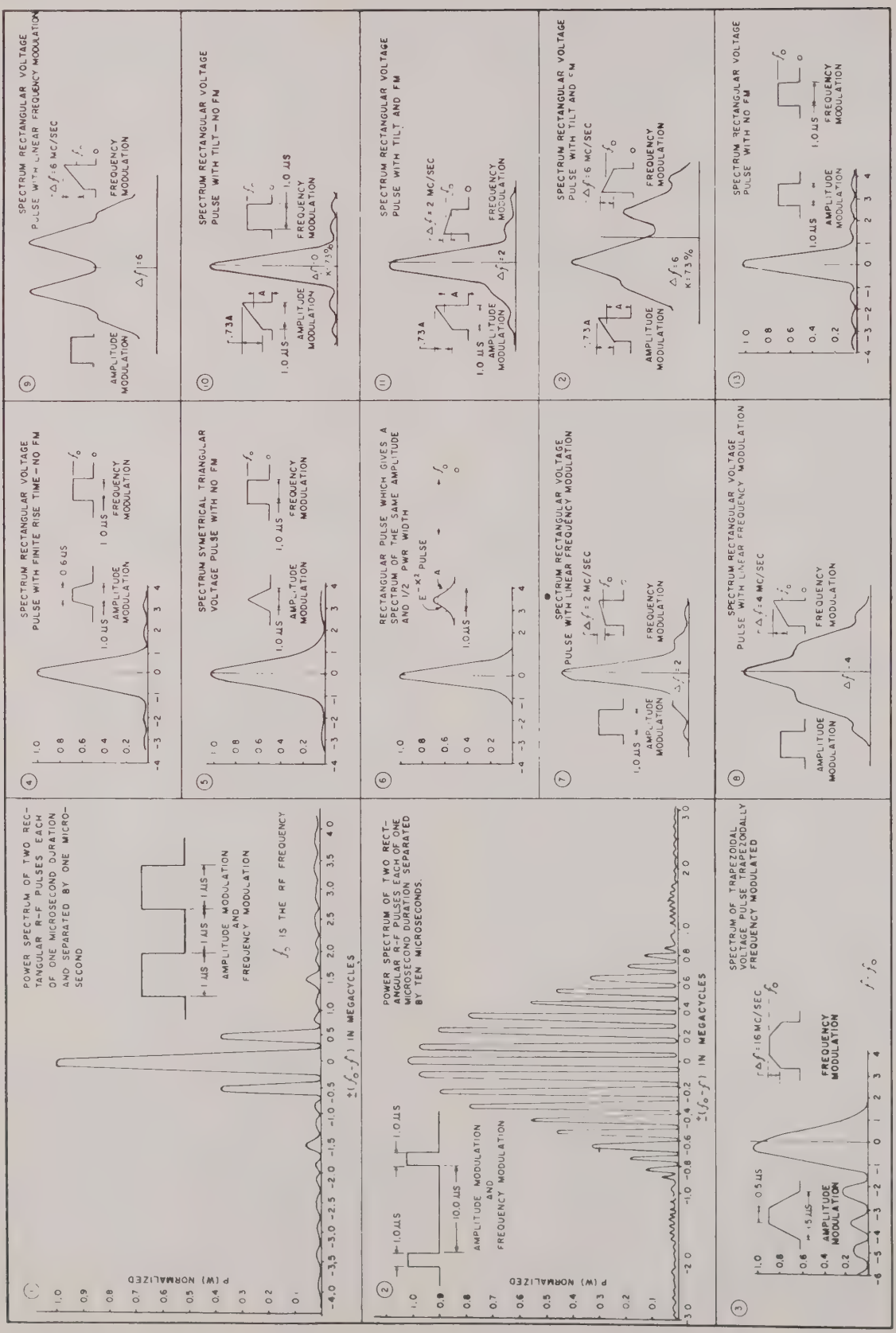

POWER SPECTRUM OF TWO RECTANGULAR R-F PULSES EACH OF ONE MICROSECOND DURATION AND SEPARATED BY ONE MICROSECOND
AMPLITUDE MODULATION AND FREQUENCY MODULATION
f_0 IS THE RF FREQUENCY
P (W) NORMALIZED
$\pm(f_0-f)$ IN MEGACYCLES
POWER SPECTRUM OF TWO RECTANGULAR R-F PULSES EACH OF ONE MICROSECOND DURATION SEPARATED BY TEN MICROSECONDS.
SPECTRUM OF TRAPEZOIDAL VOLTAGE PULSE TRAPEZOIDALLY FREQUENCY MODULATED
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH FINITE RISE TIME—NO FM
SPECTRUM SYMETRICAL TRIANGULAR VOLTAGE PULSE WITH NO FM
RECTANGULAR PULSE WHICH GIVES A SPECTRUM OF THE SAME AMPLITUDE AND 1/2 PWR WIDTH
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH LINEAR FREQUENCY MODULATION
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH LINEAR FREQUENCY MODULATION
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH LINEAR FREQUENCY MODULATION
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH TILT—NO FM
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH TILT AND FM
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH TILT AND FM
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH NO FM
AMPLITUDE MODULATION
FREQUENCY MODULATION

Figure 2-5. Representative Spectra in Signal Analysis

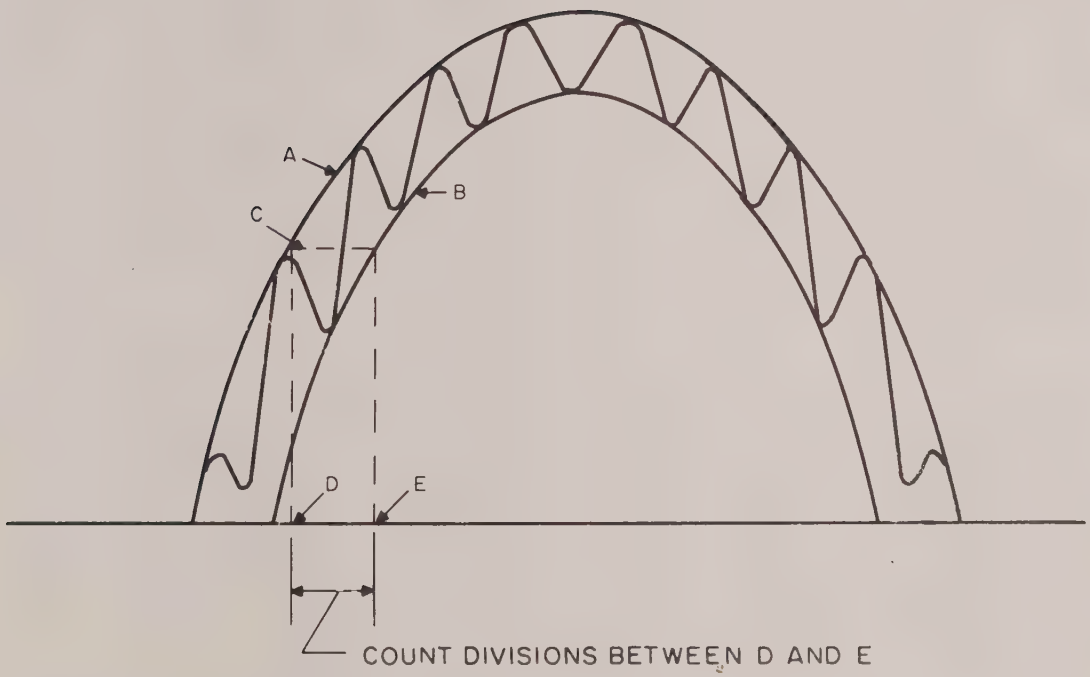


Figure 2-6 . Technique for Measuring Incidental FM

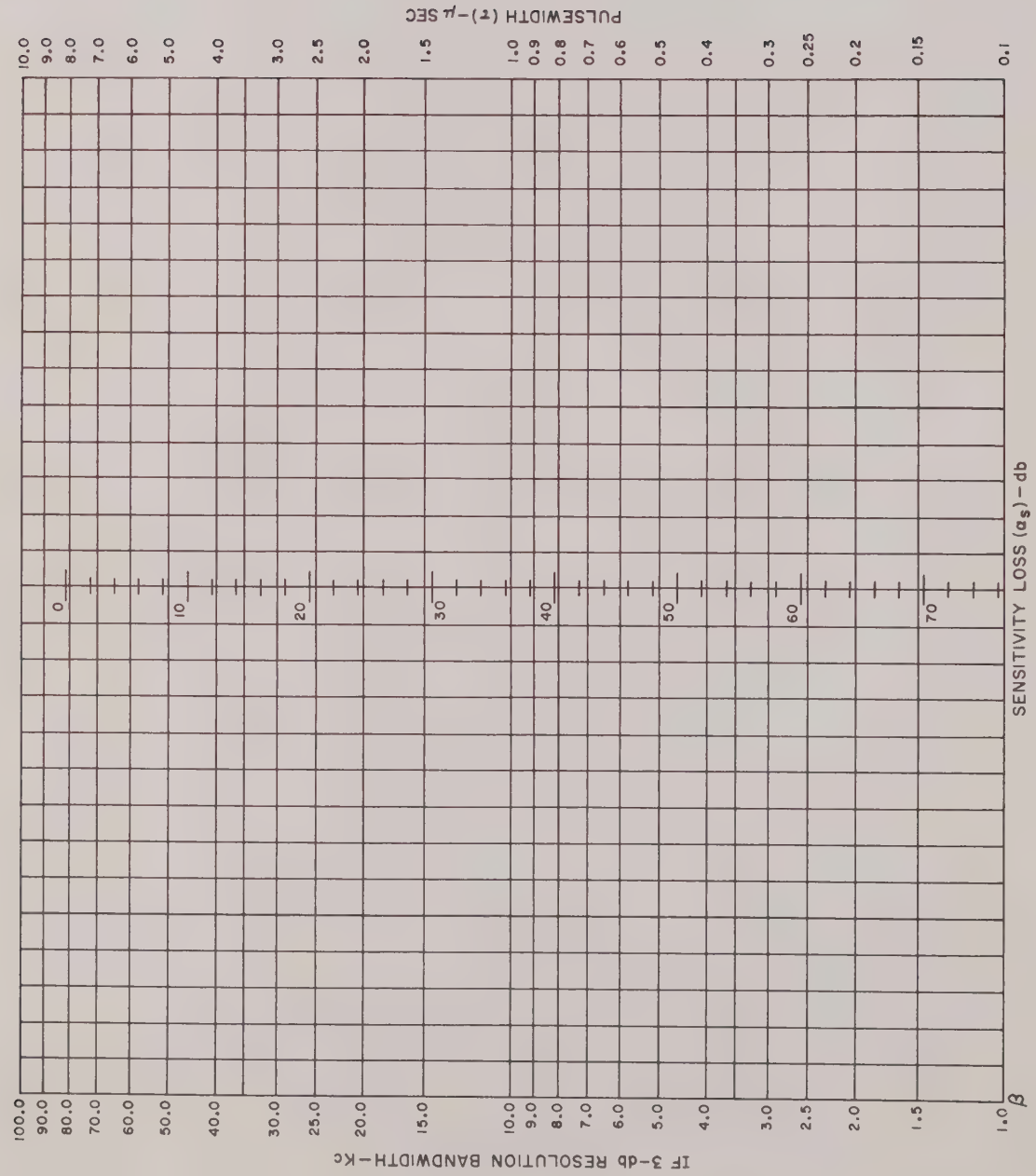


Figure 2-7. Sensitivity Loss as a Function of Signal Pulse Width and Bandwidth

SECTION III

THEORY OF OPERATION

3-1. INTRODUCTION.

3-2. The Model SA-84WA Wide Dispersion Spectrum Analyzer is a sophisticated multiple-conversion superheterodyne microwave receiver which covers the frequency range from 10 to 63,680 mc in ten bands. The SA-84WA provides a visual cathode-ray tube display of signal amplitude as a function of frequency for r-f input signals lying within its tuning range. The high resolution of the SA-84WA permits the accurate measurement of r-f signals having small frequency differences. The analysis of all conventional types of a-m, f-m, and pulsed r-f signals can be made with this wide dispersion spectrum analyzer.

3-3. The SA-84WA consists of an r-f tuning unit and a display unit. The tuning unit contains the r-f oscillators employed to generate signals used to heterodyne with the incoming r-f signal, producing the first intermediate frequency signal which is centered at 160 mc. The display unit contains a crystal calibrator, crystal filter, marker oscillator, wide-band i-f amplifier, sweep-frequency generator, narrow-band i-f amplifier, variable bandwidth i-f control amplifier, video amplifier, and six power supplies.

3-4. SIMPLIFIED BLOCK DIAGRAM ANALYSIS.

3-5. Paragraphs 3-6 through 3-23 analyze the simplified block diagram, figure 3-1.

3-6. R-F TUNING UNIT. The r-f tuning unit consists of two ganged variable r-f attenuators, two crystal mixers, three local oscillators, a preamplifier, a low-pass filter, a precision mechanical drive system, and four coaxial switches. Special shielding is provided to minimize leakage radiation, and to permit satisfactory operation of the equipment in the presence of high-powered transmitters.

3-7. R-f Attenuators. The two variable r-f attenuators in the r-f tuning unit serve to attenuate high-level (-20 dbm or greater) r-f input signals applied to the SA-84WA. Variable r-f attenuator AT101 covers the frequency range from 10 to 2,240 mc, while variable r-f attenuator AT102 covers the 2,000 to 12,400 mc range. Three external variable r-f attenuators are employed to cover the frequency range from 12,400 to 40,000 mc, as shown in figure 1-1.

3-8. Local Oscillators. Three local oscillators in the r-f tuning unit produce r-f signals which heterodyne with the incoming r-f signal. These local oscillators are of two different types; low-frequency local oscillators V103 and V102 (which cover the incoming signal frequency ranges of from 10 to 240 mc and 240 to 2,240 mc, respectively) are tuned-plate oscillators employing uhf triodes; high-frequency local oscillator V101 (which covers the incoming signal frequency range from 2,000 to 63,680 mc) employs a reflex klystron operating in an external resonant cavity.

3-9. First Crystal Mixers. Two first crystal mixers are employed in the r-f tuning unit to heterodyne the incoming r-f signal with the output of the particular local oscillator (depending on which frequency band is selected). First crystal mixer CR102 is utilized when the BAND SELECTOR switch is set to the band 1 through band 6 positions, heterodyning the incoming r-f signal with the output of the low or high frequency local oscillators. First crystal mixer CR103 is used when the BAND SELECTOR switch is in the bands 7 through 10 position, heterodyning the incoming r-f signal with the output of the high-frequency local oscillator.

3-10. Preamplifier. The r-f signal applied to the tuning unit is heterodyned with the oscillator frequency by means of the crystal mixer CR102 or CR103. The heterodyned signal is then coupled to the preamplifier sub-chassis where it is amplified.

3-11. Low-Pass Filter. The 165-mc low-pass filter which is inserted in series with the output of first crystal mixer CR102 when the SA-84WA is in band 1 operation, serves to suppress any spurious beat frequencies caused between the harmonics of low-frequency local oscillator V103 and the harmonics present in the sweep-frequency generator. The filter limits the bandwidth of the first i-f signal (in band 1 operation only) to 10 mc.

3-12. Precision Mechanical Drive System. Simultaneous tracking of both low-frequency local oscillators and the high-frequency local oscillator is

accomplished by means of a precision mechanical drive system. This drive system automatically performs the following:

a. Tracks the operating frequencies of the low-frequency local oscillators by varying the resonant frequency of their plate tank circuits.

b. Tracks the resonant frequency of the high-frequency local oscillator by varying the reflex klystron reflector voltage.

c. Tracks the resonant frequency of the external cavity employed in conjunction with the high-frequency local oscillator.

d. Tracks the FREQUENCY dial indication with rotation of the TUNING control.

3-13. Display Unit. (See figure 3-1.) The display unit consists of the following subchassis:

3-14. Crystal Calibrator. The crystal calibrator serves to produce frequency calibration pips every 1, 10, 50, or 100 mc depending on the position of the CRYSTAL CALIBRATOR switch.

3-15. Crystal Filter. The crystal filter, which is used only when the CRYSTAL CALIBRATOR switch is set to the 100 position, generates harmonics of the 100-mc output of the crystal calibrator (up through the range of the klystron local oscillator). The crystal filter is a high-pass device, eliminating those frequencies that would pass straight through the i-f circuitry.

3-16. Marker Oscillator. The marker oscillator provides an adjustable frequency marker pip which is presented on the cathode-ray tube display when the MARKER AMPLITUDE control is rotated clockwise from its OFF position. This marker pip is used to determine the following:

a. The side-band frequencies present in a portion of the displayed spectrum.

b. The frequency separation of adjacent r-f signals.

c. The width of the spectrum.

3-17. Wide-band I-f Amplifier. The wide-band i-f amplifier, which has a center frequency of 160 mc, is a stagger-damped amplifier which offers 80-mc bandwidth to the first i-f signal output of the first crystal mixer. This amplifier also passes the marker signal with the first i-f, raising the level of both to a value suitable for further conversion.

3-18. Sweep-frequency Generator. The sweep-frequency generator is a local oscillator capable of producing a swept-frequency output centered at 224 mc. The frequency deviation from the center frequency is determined by the setting of the DISPERSION HIGH-LOW switch and the DISPERSION control. The sweep-frequency generator serves to heterodyne the first i-f signal (centered at 160 mc) with the output of the swept-frequency oscillators, producing the second intermediate frequency centered at 64 mc.

3-19. I-f Step Attenuator. The i-f step attenuator, which is connected in series with the 64-mc output of the sweep-frequency generator, serves to attenuate the second i-f signal in 1-db steps from 0 to 20 db. The amount of attenuation inserted is determined by setting of the I-F ATTENUATOR DB toggle switches.

3-20. Narrow-band I-f Amplifier. The narrow-band i-f amplifier serves to amplify the 64-mc second i-f output of the sweep-frequency generator, and then converts this signal to a 6-mc third i-f. The signal then undergoes a final conversion to a 500 kc fourth i-f and is amplified and detected for application to the video amplifier.

3-21. Variable Bandwidth I-f Control Amplifier. The variable bandwidth i-f control amplifier, which is connected between the first and second converters of the narrow-band i-f amplifier, serves to adjust the resolution bandwidth of the fourth i-f signal between the limits of 1 and 80 kc, as determined by the BANDWIDTH control.

3-22. Video Chassis. The video chassis contains the necessary circuits for amplifying the detected fourth i-f signal for application to the cathode-ray tube. The video chassis also contains the circuitry required for the generation of the required crt sweep voltages, for intensifying the video information presented in the cathode-ray tube display and for blanking out the cathode-ray tube sweep retrace.

3-23. Power Supplies. Included in the display unit are six power supplies, four of which are electronically regulated. The low ripple content and high degree of regulation of the regulated supplies assure a low percentage of incidental amplitude and frequency modulation of the displayed signal. The six supplies are:

a. A regulated +125 volt supply.

b. A regulated -150 volt supply.

c. A regulated +300 volt supply.

d. A combined -325 volt and -733 volt regulated supply.

e. A high-voltage (+ and - 2, 400 volt) supply.

f. An a-c and d-c filament supply.

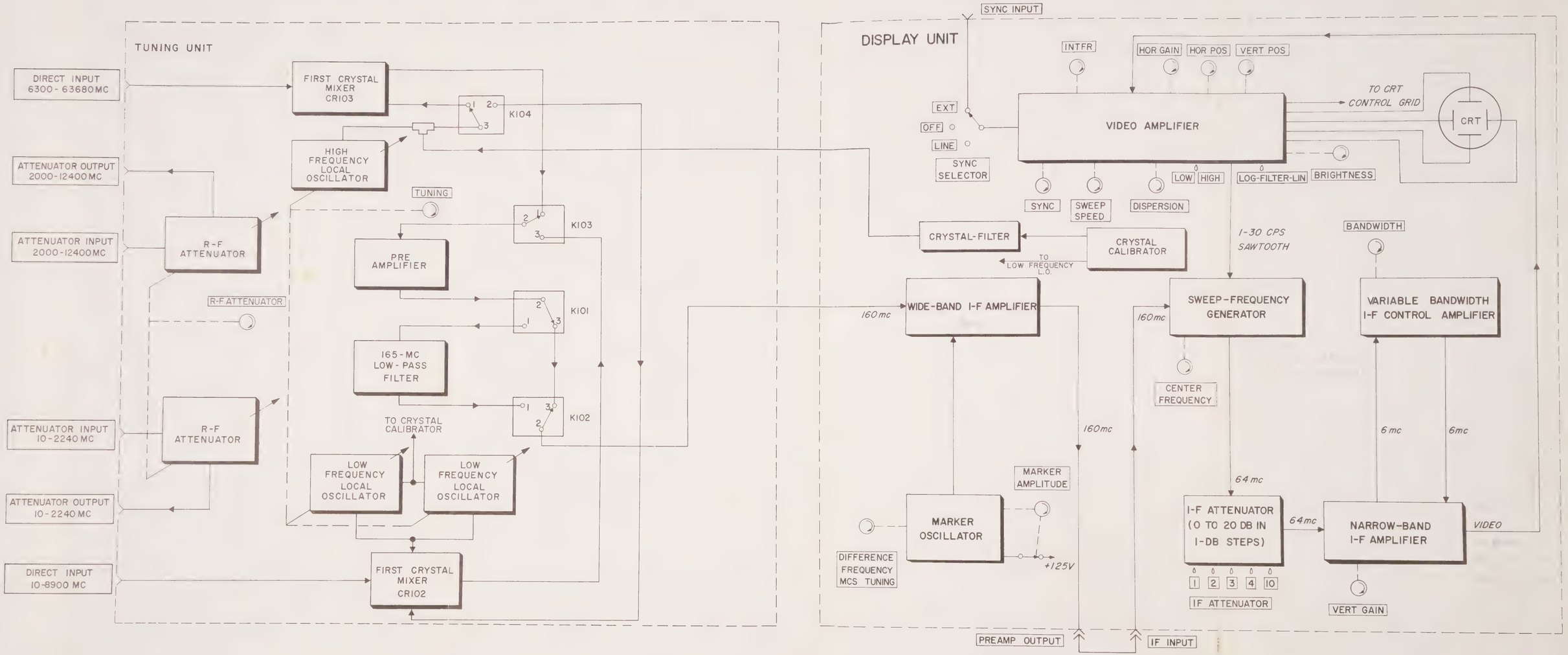


Figure 3-1. Model SA-84WA Wide Dispersion Spectrum Analyzer, Simplified Block Diagram

3-24. DETAILED CIRCUIT ANALYSIS.

3-25. The detailed block diagram, figure 3-2, should be used in conjunction with the schematic diagrams, figures 5-1 through 5-5.

3-26. R-F CIRCUIT FOR BAND 1. (See figures 3-2 and 5-1.) When the SA-84WA is in band 1 operation, the r-f input signal (10 to 240 mc) may be applied to either one of two input jacks, as follows:

a. DIRECT INPUT. When the r-f input signal is -20 dbm or less, it is applied to the DIRECT INPUT 10 - 8,900 MC jack J102. The r-f signal is coupled to first crystal mixer CR102, where it is heterodyned with the output of low-frequency local oscillator V103.

b. ATTENUATOR INPUT. When the r-f input signal is greater than -20 dbm, it is applied to the ATTENUATOR INPUT 10-2240 MC jack J103. The signal is then coupled to variable attenuator AT101, which is a piston-type waveguide-beyond-cutoff device capable of inserting up to 100 db of attenuation. The attenuated r-f signal is inductively coupled to the output of the variable attenuator and is then applied to first crystal mixer CR102, where it is heterodyned with the output of low-frequency local oscillator V103. This method of coupling the high-level incoming r-f signal reduces the possibility of first crystal mixer burnout, and simultaneously brings the signal under measurement within the dynamic range of the SA-84WA.

3-27. Low-frequency Local Oscillator V103. The local oscillator employed when the SA-84W is in band 1 operation is a uhf triode connected as a tuned-plate oscillator. The frequency of operation of V103 is determined by the resonant frequency of the plate tank circuit, which is varied by the TUNING control. Low-frequency local oscillator V103 operates at a fundamental frequency 160 mc above that indicated by the FREQUENCY dial. The output of V103 is coupled to first crystal mixer CR102.

3-28. First Crystal Mixer CR102. The output of low-frequency local oscillator V103, the incoming r-f signal, and the output of the crystal calibrator (when the CRYSTAL CALIBRATOR switch is in either the 1 or 10 position) are applied to first crystal mixer CR102. The crystal, being a non-linear device, heterodynes these three signals, producing the first intermediate-frequency signal which is centered at 160 mc. The first i-f signal is then applied, through coaxial switch S103, low-pass filter FL104 and coaxial transfer switch S104 to the wide band i-f amplifier.

3-29. R-F CIRCUITS FOR BANDS 2 THROUGH 4. (See figures 3-2 and 5-1.) When the SA-84WA is in band 2, 3, or 4 operation, the r-f input signal (240 to 2,240 mc) may be applied to either one of two input jacks, as follows:

a. DIRECT INPUT. When the r-f signal is -20 dbm or less, it is applied to the DIRECT INPUT 10 - 8,900 MC jack J102. The r-f signal is coupled to first crystal mixer CR102, where it is heterodyned with the output of low-frequency local oscillator V102.

b. ATTENUATOR INPUT. When the r-f signal is greater than -20 dbm, it is applied to the ATTENUATOR INPUT 10-2240 MC jack J103. The signal is then coupled to variable attenuator AT101, which is a piston-type waveguide-beyond-cutoff device capable of inserting up to 100 db of attenuation. The attenuated r-f signal is inductively coupled to the output of the variable attenuator and is then applied to first crystal mixer CR102, where it is heterodyned with the output of low-frequency local oscillator V102.

3-30. Low-frequency Local Oscillator V102. The local oscillator employed when the SA-84WA is in band 2, 3, or 4 operation is a uhf triode connected as a tuned-plate oscillator. The frequency of operation of V102 is determined by the resonant frequency of the plate tank circuit, which is varied by the TUNING control. Low-frequency local oscillator V102 operates at a fundamental frequency 160 mc above the incoming r-f signal in band 2 operation; at its second harmonic frequency, which is 160 mc above the incoming r-f signal in band 3 operation; and at its fourth harmonic frequency, which is 160 mc above the incoming r-f signal, in band 4 operation. The output of V102 is then coupled to first crystal mixer CR102 (see paragraph 3-28) where it is heterodyned with the incoming r-f signal and the output of the crystal calibrator (when the CRYSTAL CALIBRATOR switch is in the 50 position), producing the first intermediate frequency signal centered at 160 mc.

3-31. R-F CIRCUITS FOR BANDS 5 THROUGH 10. (See figures 3-2 and 5-1). When the SA-84WA is operated in band 5 or 6, the r-f input signal (2,000 mc to 8,900 mc) may be applied to either one of two input jacks as follows:

a. DIRECT INPUT. When the r-f signal is -20 dbm or less, it is applied to the DIRECT INPUT 10-8,900 MC jack J102. The r-f signal is coupled to the first crystal mixer CR102, where it is heterodyned with the output of the high-frequency local oscillator V101. The resultant i-f signal is then applied to the preamplifier, where it is amplified and coupled to the wide band i-f amplifier.

b. ATTENUATOR INPUT. When the r-f signal is greater than -20 dbm, it is applied to the ATTENUATOR INPUT 2,000-12,400 MC jack J105. The signal is then coupled to variable attenuator AT102, which is a piston-type waveguide-beyond-cutoff device capable of inserting up to 100 db of attenuation. The output of

the variable attenuator is then applied to first crystal mixer CR102, where it is heterodyned with the output of the high-frequency local oscillator V101 and then amplified in the preamplifier circuit. When the SA-84WA is being operated in band 7, 8, 9 or 10 (which covers the frequency range from 6,300 to 63,680 mc), external attenuators are employed which cover the waveguide frequency range from 12,800 to 63,680 mc, as shown in figure 1-1. Four waveguide-to-mixer adapters (also shown in figure 1-1) are used to connect these external attenuators to the DIRECT INPUT 12,-800 to 63,680 MC jack.

3-32. High-frequency Local Oscillator V101. When the SA-84WA is in band 5, 6, 7, 8, 9, or 10 operation, local oscillator is a reflex klystron tube operating in an external resonant cavity. The cavity is in the form of a coaxial transmission line, and consists of two cylinders, one inside the other. The reflex klystron is inserted at one end of this line so that the outer cylinder makes contact with the first interaction grid (so termed because it is closer to the cathode of the reflex klystron). The inner cylinder makes contact with the second interaction grid. The circuit is completed at the other end of the cavity by a movable non-contacting shorting plunger of special construction. The position of this shorting plunger determines the physical wavelength of the external cavity.

3-33. Reference to figure 5-1 shows that the cathode voltage of V101 is fixed at -325 volts. The reflector voltage is varied by tracking potentiometer R103 which is driven by the TUNING control. Maximum reflector voltage is limited by the reflector supply (-733 volts) and the High Limit control R102. Minimum reflector voltage is limited by the Low Limit control R104. The reflector is always maintained at a potential more negative than the cathode. The grid-to-cathode bias is determined by the setting of Anode Current control R101.

3-34. Because the reflector is maintained at a potential more negative than the cathode, the electrons that pass through the interaction grids encounter a strong decelerating field, and are slowed to a stop; they are then accelerated in the reverse direction, toward the cathode. If the r-f energy extracted from the electron stream on its return to the cathode exceeds that lost in the cavity, the excess energy is available as useful power, and the reflex klystron functions as an oscillator.

3-35. In order to maintain the proper phase between the forward and return movements of the electron stream as the frequency of operation is changed, the tuning plungers of the cavity are ganged to the reflector voltage tracking potentiometer R103. Protective diode CR104, which is connected between the cathode and reflector of V101, serves to keep the reflector from going positive with respect to the cathode, preventing possible damage to the klystron.

3-36. By employing the 2nd, 3rd, 6th, 9th and 14th harmonics of the high-frequency local oscillator, its range of operation is extended beyond its fundamental frequency range of 2,000 to 4,000 mc up to 63,680 mc.

3-37. Low-pass Filter FL104. Low-pass filter FL104 has a cut-off frequency of 165 mc, and is connected in series with the output of first crystal mixer CR102 only when the SA-84WA is in band 1 operation. This filter serves to eliminate spurious responses due to the local oscillator when operating at the low end of band 1. The filter also reduces the overall bandwidth of the first i-f signal to 10 mc.

3-38. Preamplifier. The signal follows two paths. The first path leads through inductors L851 and L852 and filter FL851 to meter M101 for monitoring of the crystal current. The other path conducts the signal through capacitor C582 to the transistor Q851 where it is amplified. The output is transformer-coupled by means of T851 (with its primary tuned to resonance) to the wide band i-f amplifier through coupling capacitor C587 and relays K101 and K102.

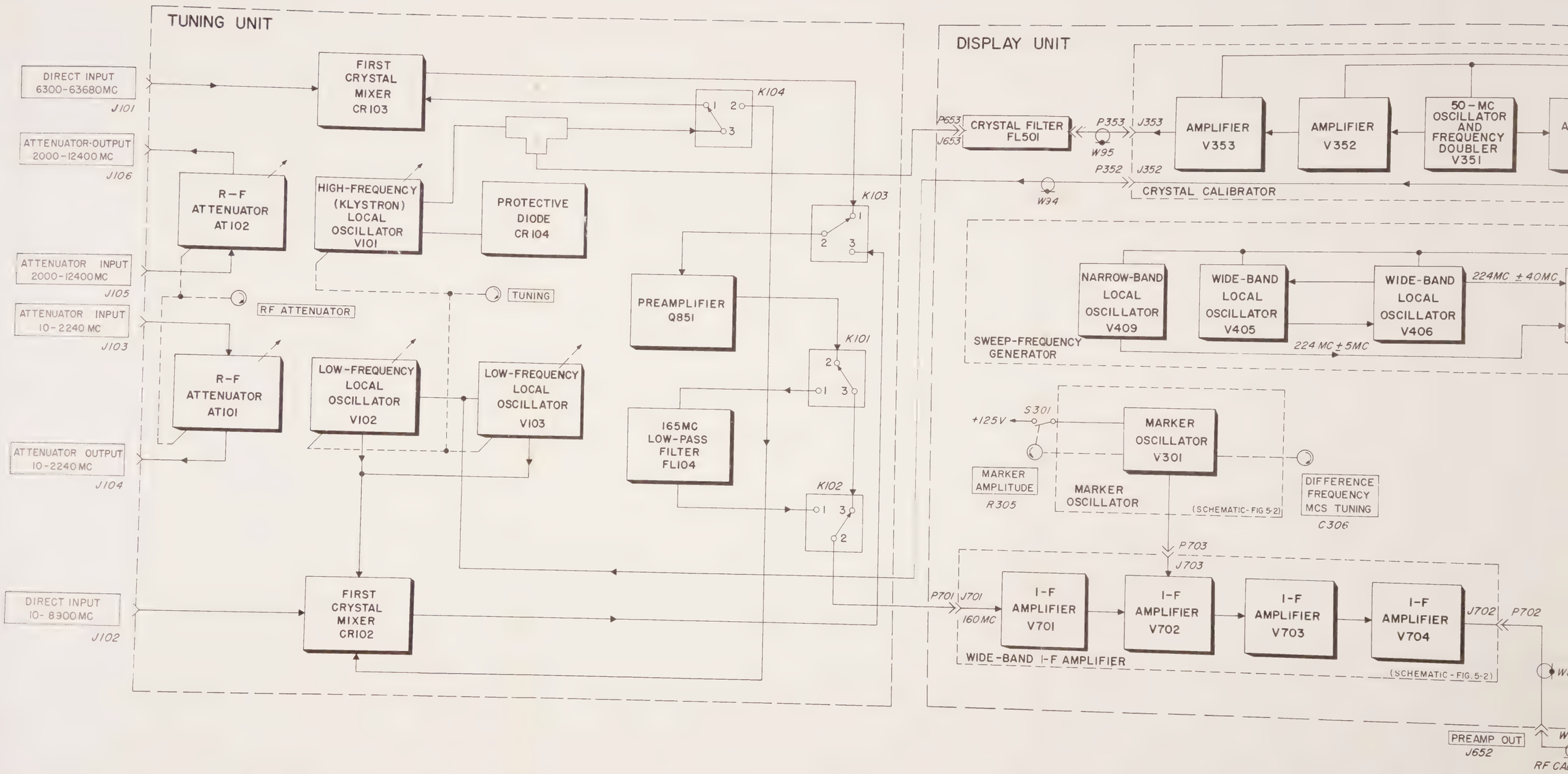
3-39. R-F TUNING UNIT SWITCHING CIRCUITRY. (See figure 5-1.) The band-selecting switching circuitry of the tuning unit activates the proper local oscillator, connects the output of the proper first crystal mixer to the wide-band i-f amplifier, and inserts the 165-mc low-pass filter into the i-f line, as follows:

a. When the BAND SELECTOR switch S102 is rotated to the band 1 position, the wiper arm of section B makes contact with pin 1, thereby applying +125 volts to low-frequency local oscillator V103. The wiper arm of section CF makes contact with pin 1, energizing relay K501 (located in the video amplifier), causing the SA-84WA to operate in narrow dispersion. The wiper arm of section CR makes contact with pin 1, energizing relays K101 and K102, which inserts the 165-mc low-pass filter between the output of first crystal mixer CR102 and the wide-band i-f amplifier.

b. When the BAND SELECTOR switch is rotated to the band 2, band 3, or band 4 position, the wiper arm of section B makes contact with pin 2, pin 3, or pin 4, respectively, thereby applying +125 volts to the low-frequency local oscillator V102. The wiper arms of all the other sections do not make contact with any pins, therefore the output of first crystal mixer CR102 is coupled to the wide-band i-f amplifier.

c. When the BAND SELECTOR switch is rotated to any one of the remaining six positions (bands 5, 6, 7, 8, 9 or 10), the wiper arm of section A applies the required operating voltages (-325 and -733 volts) to the reflex klystron. The wiper arm of section C causes the output of the first crystal mixer CR102 or CR103 to be coupled to the preamplifier, where it is amplified and coupled to the wide band amplifier.

3-40. METER SELECTOR switch S101 permits the


TUNING UNIT
DIRECT INPUT 6300-63680MC
J101
ATTENUATOR-OUTPUT 2000-12400 MC
J106
ATTENUATOR INPUT 2000-12400MC
J105
ATTENUATOR INPUT 10-2240 MC
J103
ATTENUATOR OUTPUT 10-2240 MC
J104
DIRECT INPUT 10-8900 MC
J102
FIRST CRYSTAL MIXER CR103
K104
R-F ATTENUATOR AT102
HIGH-FREQUENCY (KLYSTRON) LOCAL OSCILLATOR V101
PROTECTIVE DIODE CR104
K103
RF ATTENUATOR
TUNING
PREAMPLIFIER Q851
K101
R-F ATTENUATOR AT101
LOW-FREQUENCY LOCAL OSCILLATOR V102
LOW-FREQUENCY LOCAL OSCILLATOR V103
165MC LOW-PASS FILTER FL104
K102
FIRST CRYSTAL MIXER CR102
DISPLAY UNIT
P653
J653
CRYSTAL FILTER FL501
P353
W95
J353
AMPLIFIER V353
AMPLIFIER V352
50-MC OSCILLATOR AND FREQUENCY DOUBLER V351
P352
J352
W34
CRYSTAL CALIBRATOR
NARROW-BAND LOCAL OSCILLATOR V409
WIDE-BAND LOCAL OSCILLATOR V405
WIDE-BAND LOCAL OSCILLATOR V406
224MC ± 40MC
224 MC ± 5MC
SWEEP-FREQUENCY GENERATOR
+125V
S301
MARKER OSCILLATOR V301
MARKER AMPLITUDE
R305
MARKER OSCILLATOR
(SCHEMATIC-FIG 5-2)
DIFFERENCE FREQUENCY MCS TUNING
C306
P703
J703
P701
J701
160MC
I-F AMPLIFIER V701
I-F AMPLIFIER V702
I-F AMPLIFIER V703
I-F AMPLIFIER V704
J702
P702
WIDE-BAND I-F AMPLIFIER
(SCHEMATIC-FIG 5-2)
PREAMP OUT
J652

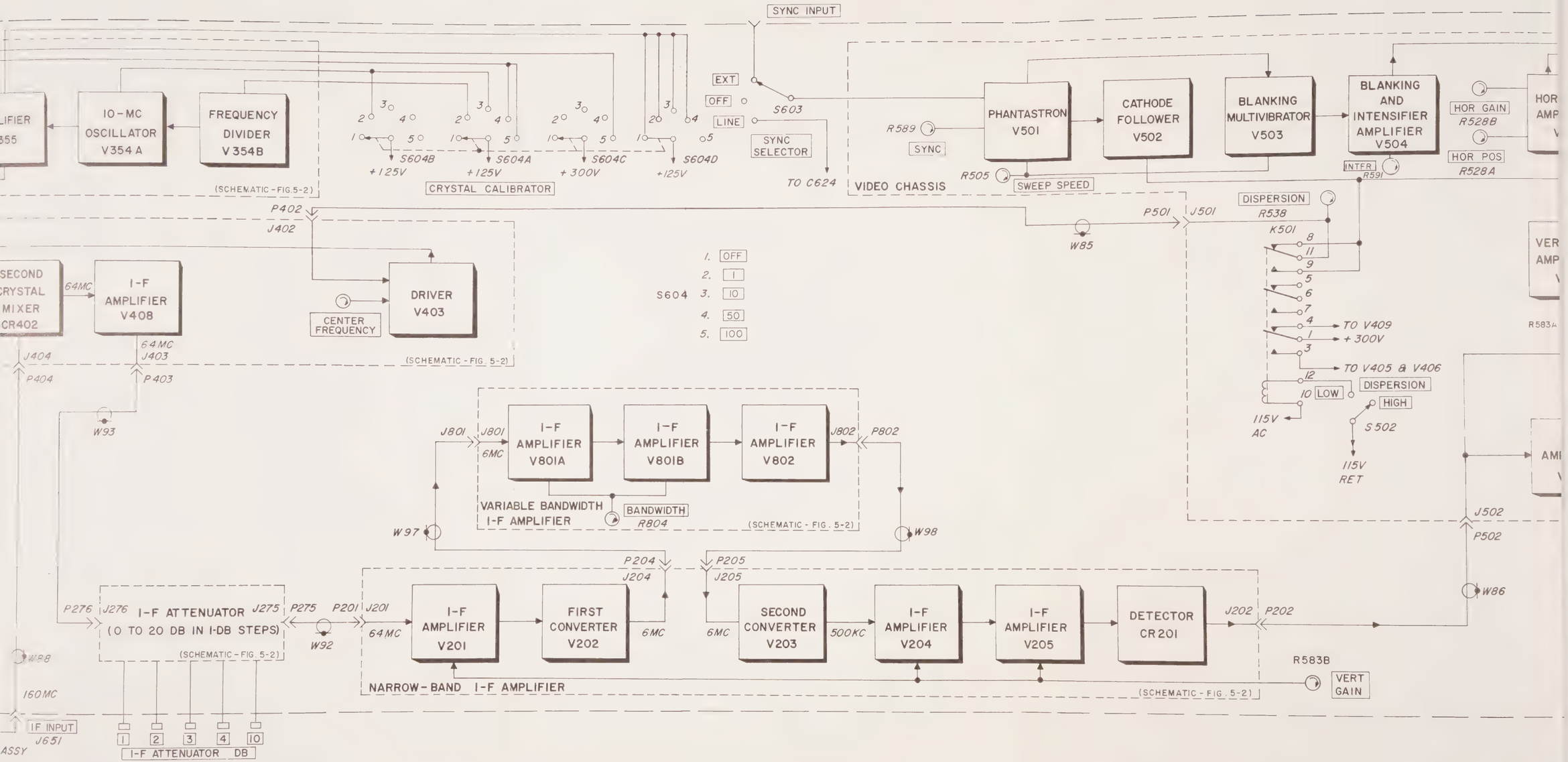
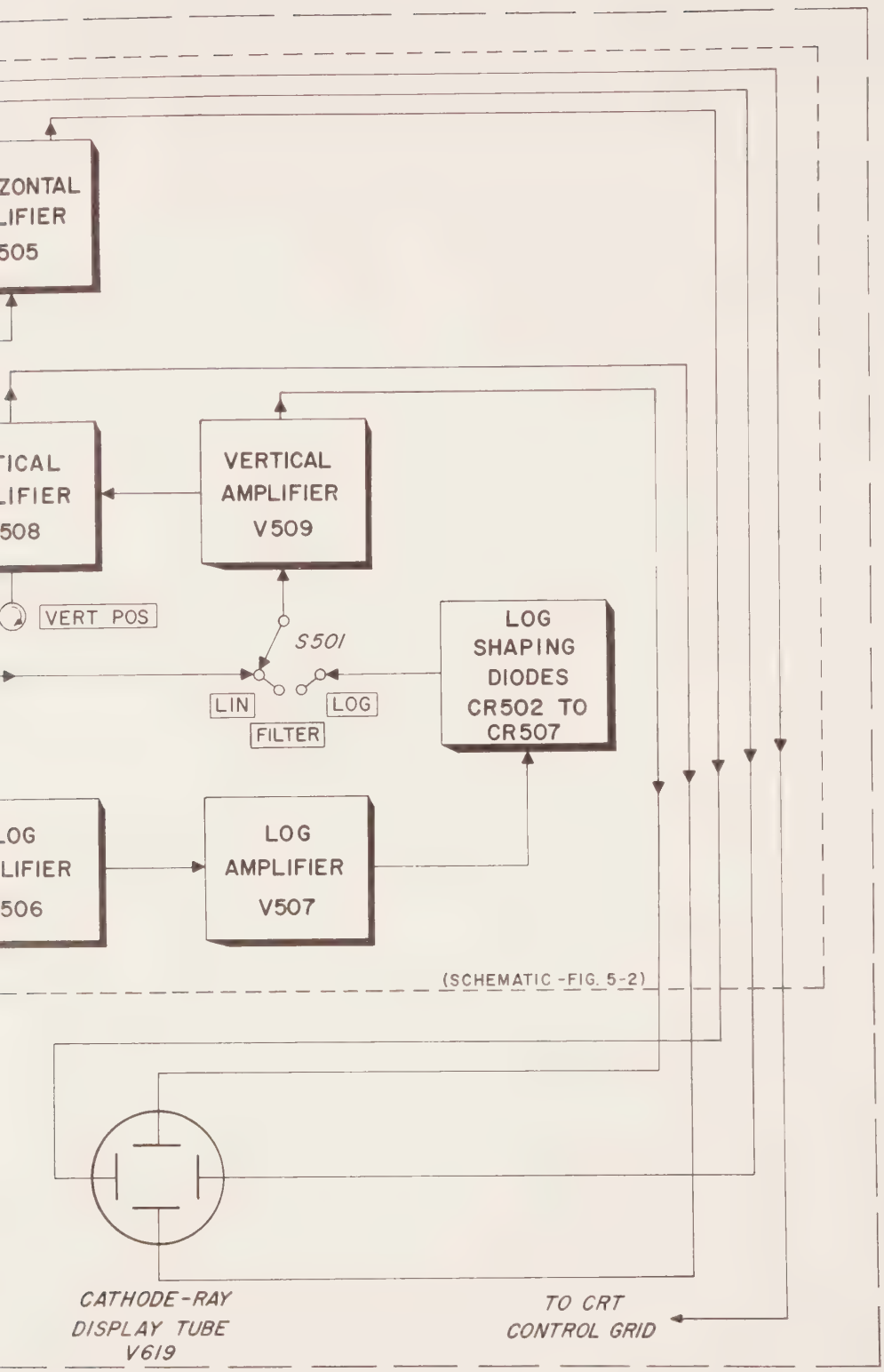


Figure 3-2. Model SA



84WA Wide Dispersion Spectrum Analyzer, Detailed Block Diagram

application of the reflector (-733-volt) supply, the +125-volt supply, the +300-volt supply, the line voltage, or the first crystal mixer current to monitor meter M101 for visual monitoring. When the METER SELECTOR switch is set to the OFF position, the monitor meter is disconnected from the monitoring circuitry.

3-41. CRYSTAL CALIBRATOR. (See figures 3-2 and 5-2.) The crystal calibrator consists of two oscillators, operating at 50 and 10 mc respectively. The 10-mc crystal-controlled oscillator drives a frequency divider in such a manner as to hold its frequency of 1 mc within the accuracy of the 10-mc crystal. Frequency is controlled in the following manner:

a. When the CRYSTAL CALIBRATOR switch S604 is rotated to the 100 position, the plate circuits of the 50-mc oscillator V351, the frequency doubler V352, and the amplifier V353 are energized. The series-resonant crystal-controlled oscillator V351, tuned to 50-mc, drives the grid of V352, a conventional class-C doubler with its plate circuit tuned to 100 mc. The output of V352 is coupled to the grid of the amplifier V353 which increases the amplitude of the 100-mc signal and transformer couples it to the crystal filter. The crystal filter, being a non-linear device, generates harmonics of the 100 mc signal, and filters out the unwanted lower harmonics that would feed straight through to the i-f. These signals are coupled to first crystal mixers CR102 and CR103 and are heterodyned with the output of high-frequency local oscillator V101.

b. When the CRYSTAL CALIBRATOR switch is rotated to the 50 position, the plate circuits of the 50-mc oscillator V351 and amplifier V355 are energized. The output of the 50-mc oscillator V351 is applied to the control grid of the amplifier V355, which is operated in its non-linear region, thereby producing harmonics of the 50-mc input signal. The fundamental signal and its harmonics are coupled to the first crystal mixer CR102, which heterodynes them with the output of the low-frequency local oscillator V102.

c. When the CRYSTAL CALIBRATOR switch is rotated to the 10 position, the plate circuits of the 10-mc oscillator V354A and the amplifier V355 are energized. The tuned-plate tuned-grid crystal-controlled local oscillator, V354A, is coupled to the grid of the amplifier V355, which is operated in its non-linear region, thereby producing harmonics of the 10-mc signal. The fundamental signal and its harmonics are coupled to the first crystal mixer CR102, which heterodynes them with the output of the low-frequency local oscillator V103.

d. When the CRYSTAL CALIBRATOR switch is rotated to the 1 position, the plate circuits of the 10-mc oscillator V354A, the frequency divider V354B, and the amplifier V355 are energized. The output frequency of the divider V354B is the tenth sub-harmonic of V354A. The output of V354B is coupled to the amplifier V355, which is operated in its non-linear region, thereby producing harmonics of the 1-mc signal. The fundamental signal and the harmonics are coupled to the first crystal mixer CR102 which heterodynes them with the output of the low-frequency local oscillator V103. The frequencies at which the crystal calibrator pips appear on the display are indicated in table 3-1.

3-42. MARKER OSCILLATOR. (See figures 3-2 and 5-2.) Marker Oscillator V301 is a high frequency Colpitts oscillator tuned to a center frequency of 160 mc. The operating frequency of the marker oscillator is controlled by the FREQUENCY DIFFERENCE MCS TUNING control, thus providing a variable frequency marker pip for calibrating the display and for determining small frequency differences of displayed signals. It also provides a rapid check to determine the operation of the i-f and video amplifiers.

3-43. Frequency variations of up to ±40 mc may be obtained by rotation of the FREQUENCY DIFFERENCE MCS TUNING control. The deviation from the 160-mc center frequency is displayed on the DIFFERENCE FREQ-MCS dial, which is engraved in 1.0 mc increments from -40 mc to +40 mc. Provision is made for adjusting the amplitude of the marker pip by means of MARKER AMPLITUDE control R305. The marker oscillator signal may be removed from the i-f circuitry by rotating the MARKER AMPLITUDE control fully counterclockwise, to its OFF position. The output of the marker oscillator is coupled, via cable W301 and jack J703, to the wide-band i-f amplifier.

3-44. WIDE-BAND I-F AMPLIFIER. (See figures 3-2 and 5-2.) The 160-mc center frequency first i-f signal from the tuning unit is applied to input jack J701 of the wide-band i-f amplifier via coaxial cable assembly W91. This is coupled through the 160-mc resonant circuit comprised of inductor L719 and capacitor C741, to the cathodes of grounded-grid amplifier V701. This i-f stage serves as an impedance matching device, matching the 50-ohm cable impedance to the input impedance of the grounded-grid second stage V702. The stagger-damped cascode amplifier, V702, has a center frequency of 160 mc and a bandwidth of 80 mc. The amplified output of V702B is taken across variable inductor L704 and coupled to the grid of V703A. Amplifiers V703 and V704 are similar to V702 in operation. They are both stagger-damped cascode amplifiers, providing adequate gain over the 80-mc bandwidth of the wide-band i-f amplifier. The output of the marker oscillator (when the MARKER AMPLITUDEcontrol is rotated clockwise, from its OFF position) is applied to the control grid (pin 7) of i-f amplifier V703A.

3-45. SWEEP-FREQUENCY GENERATOR. (See figures 3-2 and 5-2.) The sweep-frequency generator serves the dual function of generating a swept frequency whose center frequency is 224 mc and

TABLE 3-1. CRYSTAL CALIBRATOR CALIBRATION POINTS

BAND 1*	BAND 2	BAND 3	BAND 4	BAND 5	BAND 6	BAND 7	BAND 8	BAND 9	BAND 10
10 MC Markers At	50 MC Markers At	50 MC Markers At	50 MC Markers At	100 MC Markers At	100 MC Markers At	100 MC Markers At	100 MC Markers At	100 MC Markers At	100 MC Markers At
10	250	660	1070	2000	4360	6620	13, 400	20, 180	41, 280
20	300	760	1220	2100	4560	6920	14, 000	21, 080	42, 680
30	350	860	1370	2200	4760	7220	14, 600	21, 980	44, 080
40	400	960	1520	2300	4960	7520	15, 200	22, 880	45, 480
50	450	1060	1670	2400	5160	7820	15, 800	23, 780	46, 880
60	500	1160	1820	2500	5360	8120	16, 400	24, 680	48, 280
70	550	1260	1970	2600	5560	8420	17, 000	25, 580	49, 680
80	600	1360	2120	2700	5760	8720	17, 600	26, 480	51, 080
90				2800	5960	9020	18, 200	27, 380	52, 480
100				2900	6160	9320	18, 800	28, 280	53, 880
110				3000	6360	9620	19, 400	29, 180	55, 280
120				3100	6560	9920	20, 000	30, 080	56, 680
130				3200	6760	10, 220	20, 600	30, 980	58, 080
140				3300	6960	10, 520	21, 200	31, 880	59, 480
150				3400	7160	10, 820	21, 800	32, 780	60, 880
160				3500	7360	11, 120	22, 400	33, 680	62, 280
170				3600	7560	11, 420	23, 000	34, 580	63, 680
180				3700	7760	11, 720	23, 600	35, 480	
190				3800	7960	12, 020	24, 200	36, 380	
200				3900	8160	12, 320	24, 800	37, 280	
210				4000	8360	12, 620	25, 400	38, 180	
220				4100	8560	12, 920	26, 000	39, 080	
230				4200	8760	13, 220	26, 600	39, 980	
240				4300			27, 200	40, 880	
				4400					

*Also 1-Mc markers at every megacycle.

heterodyning this swept signal with the 160-mc output of the wide-band i-f amplifier. The amount of sweep (or deviation) from the 224-mc center frequency is determined by the amplitude of the sawtooth voltage obtained from the video chassis. Coarse adjustment of this sawtooth voltage is accomplished by DISPERSION HIGH-LOW switch S502 and fine adjustment by the DISPERSION control R538.

3-46. The sweep-voltage output of the video amplifier is coupled, via jack J501, coaxial cable assembly W85, and jack J402, to the control grid of the d-c amplifier V403. The center frequency of the oscillators is controlled by the CENTER FREQUENCY COARSE and FINE controls. These controls provide a d-c voltage which is added to the sawtooth signal present at the grid of V403. The current sawtooth applied to reactor L403 causes a flux change in the gap of its laminations. In this gap ferrite cores are placed on which L405 and L407 are wound. The change in flux varies the permeability of the cores which causes the inductance of L405 and L407 to vary. This produces a frequency change in the oscillators. To compensate for the slight nonlinearity of the circuit an additional d-c bias current is applied to the reactor L403, controlled by R403.

3-47. When the DISPERSION HIGH-LOW switch is in the HIGH position, the high dispersion swept-frequency local oscillator is energized, producing a signal whose frequency is swept between the limits of 184 mc and 264 mc (center frequency of 224 mc). This signal is coupled to the second crystal mixer CR402, which heterodynes it with the 160-mc output of the wide-band i-f amplifier, producing the second i-f signal centered at 64 mc.

3-48. When the DISPERSION HIGH-LOW switch is in the LOW position, the low dispersion swept-frequency local oscillator is energized, producing a signal whose frequency is swept between the limits of 219 mc and 229 mc (the center frequency again being 224 mc). In both cases (HIGH or LOW position of the DISPERSION HIGH-LOW switch) the frequency excursion of the local oscillators specified is for full clockwise rotation of the DISPERSION control. The excursion is reduced when the control is adjusted to any position other than fully clockwise.

3-49. The second intermediate frequency signal produced in the second crystal mixer CR402 is transformer coupled (via L408, which is tuned to 64 mc) to the control grid of the i-f amplifier V408. The output of this stage is transformer coupled (via L409, which is also tuned to 64 mc) to the input jack of the i-f attenuator (via J403 and coaxial cable assembly W93).

3-50. I-F STEP ATTENUATOR. (See figure 5-2.) The i-f step attenuator consists of a five-section pi-type attenuator network, each section being individually controlled by a front panel toggle switch. The 64 mc second i-f signal can be attenuated in 1-db steps, from 0 to 20 db, depending on which I-F ATTENUATOR DB toggle switch or switches are placed in the up position. The output of the i-f step attenuator is coupled, via jack J275 and coaxial cable assembly W92, to the input jack of the narrow-band i-f amplifier.

3-51. NARROW-BAND I-F AMPLIFIER. (See figures 3-2 and 5-2.) The narrow-band i-f amplifier serves the triple purpose of amplifying the second i-f signal, converting the second i-f signal first to 6 mc (third i-f) and then to the final i-f frequency of 500 kc, and detecting the fourth i-f signal. The video information is then applied to the video amplifier.

3-52. The 64-mc output of the wide-band i-f amplifier is applied to the primary of transformer T201, which is tuned to 64 mc. The signal appearing at the secondary is coupled to the control grid of i-f amplifier V201. The output of this amplifier is taken across the parallel resonant tank circuit comprised of variable inductor L202 (which is tuned to 64 mc) and capacitor C205, and is coupled to the third grid (pin 7) of converter V202.

3-53. The local oscillator section of the pentagrid converter, V202, is controlled by the crystal Y201. This crystal is connected between the control grid (pin 1) and the second and fourth grids (pin 6). The second and fourth grids act as the tuned plate and the control grid as the grid of a 58-mc triode oscillator. The oscillator output is coupled through the electron stream to modulate the incoming 64-mc signal. The plate load, consisting of variable inductor L225 (and the associated stray capacitance) is tuned to 6 mc, passing the 6-mc signal resulting from the second harmonic of crystal Y201 and the 64-mc second i-f. This third i-f signal of 6 mc is coupled, via jack J204 and coaxial cable assembly W97, to the variable bandwidth i-f control amplifier, which provides a means of adjusting the bandwidth of the third i-f signal.

3-54. The output of the variable bandwidth i-f control amplifier is returned to the narrow-band i-f amplifier, via coaxial cable assembly W98 and jack J205, and is coupled to the third grid (pin 7) of V203, a pentagrid converter. The second and fourth grids act as the plate and the control grid is the grid of the 6.5-mc triode oscillator. The oscillator output is coupled through the electron stream to modulate the incoming 6-mc signal. The plate load, consisting of variable inductor L209 (which is tuned to 500 kc) and capacitor C221, passes the 500-kc fourth i-f signal to the control grid of the i-f amplifier V204.

3-55. The i-f amplifiers V204 and V205, in cascade, amplify the 500-kc signal to a level sufficient to provide a demodulated signal capable of fully driving the vertical amplifiers. The output of V205 is coupled to the detector CR201, which rectifies the fourth i-f

signal. The detected signal is then coupled to the video amplifier via jack J202 and coaxial cable assembly W86.

3-56. The over-all gain of the narrow-band i-f amplifier is controlled by VERT GAIN control R583B located in the video chassis. Rotation of this control adjusts the d-c potential applied to the cathodes of the i-f amplifiers V201 and V204, thus determining the gain of these stages.

3-57. VARIABLE BANDWIDTH I-F CONTROL AMPLIFIER. (See figures 3-2 and 5-2.) The variable bandwidth i-f control amplifier serves to adjust the final resolution bandwidth of the i-f signal within the range from 1 to 80 kc. The control amplifier is basically two crystal filter stages (V801A and V801B) and an amplifier stage (V802).

3-58. The first crystal filter stage is basically a bridge configuration with the arms being R802, R803, C802, and Y801. The output is developed across T801. The bandwidth, when coupled through Y801, is very narrow because the crystal is effectively an extremely high-q resonant circuit. The bandwidth, when coupled through C802, results in the response of the normal l-c resonant circuit. When the BANDWIDTH control R804B is at its extreme counter-clockwise (shorted) position, the output signal across T801 is produced only by the coupling through Y801 which results in an extremely narrow-band signal. Conversely, when R804B is at its extreme clockwise position (effectively open), the output signal is produced by the broadband coupling through C802. The second stage operates in the same manner. Combined, they control the i-f bandwidth over an extremely large range.

3-59. The output of V801B is amplified by V802. The output of this stage is coupled (via J802 and coaxial cable assembly W98) back to the narrow-band i-f amplifier.

3-60. VIDEO CHASSIS. (See figures 3-2 and 5-2.) The video chassis serves to generate the necessary sweep voltages required for the presentation of the video information on the screen of the cathode-ray display tube. It also amplifies the information to be displayed, and generates an intensifying and blanking potential which is applied to the control grid of the crt.

3-61. Log Shaping Circuit. A logarithmic display of the applied signal amplitude is presented on the crt screen after flowing through a diode segmentation circuit which operates as follows:

a. The output of the narrow-band i-f amplifier is applied to the video amplifier via coaxial cable assembly W86 and jack J502. The detected 500-kc video signal appears at both the control grid of the log amplifier V506 and the LIN contact of the LOG-FILTER-LIN switch S501.

b. When the LOG-FILTER-LIN switch is in the LOG position, the incoming video signal is amplified by the log amplifier V506. The output of this stage is coupled to the control grid of the log amplifier V507A for further amplification. The output of V507A is then applied to the control grid of V507B, which is a cathode follower. The signal is then applied to the diode segmentation circuit comprised of the crystal diodes CR502 through CR507 and their associated resistors. Due to the biasing resistors connected to the diodes, each diode conducts at a signal voltage greater than the last. In this manner, the voltage drop across resistor R559 causes the output (which appears at S501) to approach the log of the applied signal voltage.

3-62. The output of the log-circuit (when the LOG-FILTER-LIN switch is in the LOG position) or the output of the narrow-band i-f amplifier (when the LOG-FILTER-LIN switch is in the LIN position) is coupled to the control grid of the vertical amplifier V508. When the LOG-FILTER-LIN switch is in one of the FILTER positions, the video frequency response is reduced by the addition of C516. This suppresses the unwanted beat frequencies that are normally produced when comparing two signals separated by a very small frequency difference. The vertical amplifiers V508 and V509 operate as cathode-coupled push-pull balanced deflection amplifiers. The use of balanced amplifiers insures proper linearity and minimum distortion of the displayed video information. The vertical positioning of the display is adjusted by VERT POS control R583A. The video output of the vertical amplifiers is directly coupled to the vertical deflection plates of the cathode-ray tube through pins A and B of mating connectors J504 and P504. Direct coupling provides a two-fold advantage; it permits broadband frequency response down to d-c and at the same time permits instantaneous trace positioning.

3-63. Sawtooth Generator. The function of the sawtooth generator is to provide the timing reference voltage for the horizontal amplifier V505, the blanking multivibrator V503, and the sweep-frequency generator. This sawtooth voltage repetition rate is adjustable over the range from 1 to 30 cps by means of SWEEP SPEED control R505. Synchronization with the internal power line frequency may be set with SYNC control R589.

3-64. The sawtooth generator is comprised of the phantastron V501 and the cathode follower V502, which combine to form a free-running screen-coupled phantastron sawtooth voltage generator. The phantastron V501 employs a pentode with two control grids. The suppressor grid has a sharp cutoff characteristic, and is used as an independent control element. Initially, the screen grid (pin 6) is conducting heavily, while the suppressor grid (pin 7) is effectively cutting off the plate (pin 5) current. (See A, B, and C of figure 3-3.) The instantaneous plate voltage (figure 3-3A) is at its maximum value. At the same time, the control grid (figure 3-3D) is at zero bias

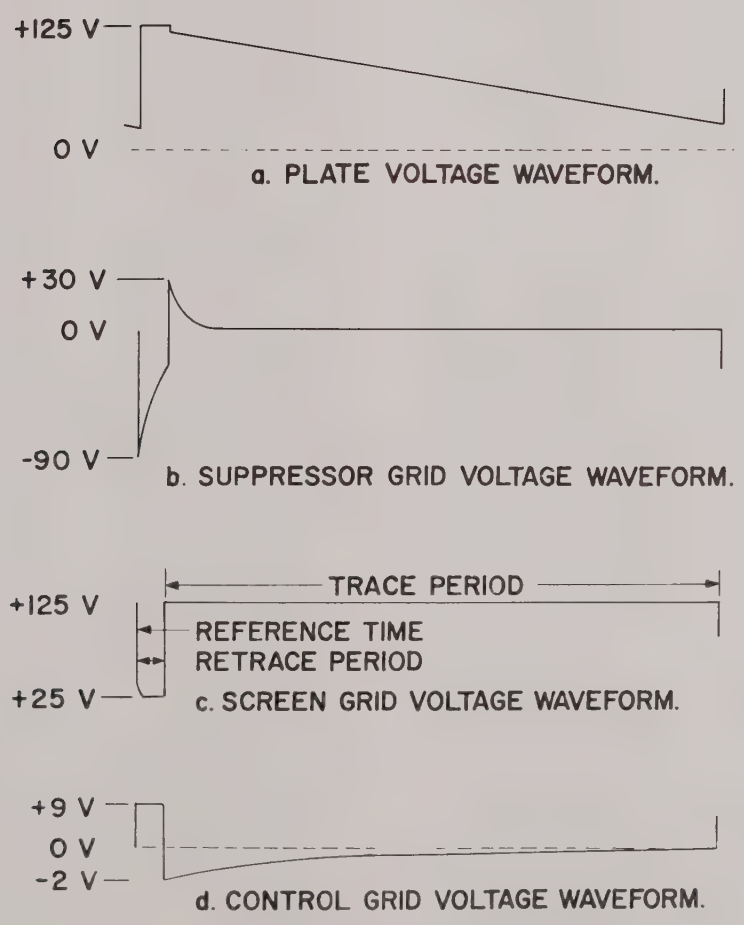


Figure 3-3. Sawtooth Generator Voltage Waveforms

due to the positive voltage return of grid resistors R504 and R505A in series. The presence of any transient negative pulse at the plate of V501 is fed back to the control grid of V501 via the cathode follower V502. This action causes the screen current to fall, resulting in a simultaneous rise in screen voltage (figure 3-3C). This voltage change is coupled to the suppressor grid (pin 7) through C504, causing the suppressor grid to initiate and maintain the plate current. The plate current now rises (with the plate voltage dropping) at a rate determined by the rc time constant of the grid circuit (C503, R504, and R505A). Waveform linearity is obtained by feedback between the plate and grid (pin 1). This feedback tends to maintain a constant current through the grid capacitor. The rise in plate current (and fall in plate voltage) continues until the plate bottoms and the tube saturates. At this point (figure 3-3A) the control grid voltage reverts to its normal zero bias condition, causing the screen and suppressor potentials to be restored to their original values. The plate current now starts to fall (plate voltage rises) until the plate voltage reaches +125 volts. The presence of a synchronizing voltage at the suppressor grid insures a constant sawtooth rate, determined by the setting of SWEEP SPEED control R505A.

3-65. Horizontal Amplifier. The sawtooth voltage output of the cathode follower V502A is applied to the control grid (pin 2) of the horizontal amplifier V505A (through HOR GAIN control R528B). The twin-triode amplifier, V505, functions as a cathode-coupled push-pull balanced amplifier. The sawtooth voltage is applied to the horizontal deflection plates of the cathode-ray tube V619. The use of balanced amplifiers insures proper linearity and minimum distortion of the horizontal sweep voltage. Horizontal positioning of the trace is effected by means of HOR POS control R528A. The horizontal output of V505 is directly coupled, via pins C and D of connectors J504 and P504, to the cathode-ray tube, thus assuring linear operation at low sweep speeds.

3-66. Blanking Multivibrator. A portion of the output of the sawtooth generator, which consists of a pulse developed at the screen grid of the phantastron V501, is coupled to the control grid (pin 7) of the blanking multivibrator V503 through the crystal CR501. The polarity of CR501 is such that only negative going pulses are passed to the grid. This negative-going pulse triggers V503, which functions as a one-shot cathode-coupled multivibrator. The negative going pulse corresponds to the start of the retrace period. For proper blanking, the width of this pulse must be adjusted to correspond to the retrace period. This is automatically accomplished by the ganged connection of R505B to the SWEEP SPEED control R505A. R515 is factory pre-set to adjust the tracking of R505B with R505A. The amplified output of the blanking multivibrator is coupled to the control grid of V504A.

3-67. Blanking And Intensifier Amplifier. The output of V503 is applied to the control grid (pin 2) of V504A, where the signal is amplified and inverted. The inverted signal, which is of negative polarity, is applied to the control grid of the cathode-ray tube, blanking the display on the retrace portion of the display.

3-68. The output of the vertical amplifier V508 is also coupled to the control grid of V504B. During those portions of the trace period when video information is being amplified by the vertical amplifier, the negative signal appearing at the plate of V508 is coupled to the control grid of V504B. This signal is amplified and inverted, and then applied to the control grid of the cathode-ray tube. In this manner, the displayed video information is amplified while the base line intensity remains unchanged. Both the blanking and intensifier signals are available at the plate (pin 6) of V504.

3-69. POWER DISTRIBUTION.

3-70. Power for the Model SA-84WA Spectrum Analyzer is obtained from two unregulated and four regulated supplies. The unregulated supplies furnish the filament voltages, both a-c and d-c, and the high voltages for the cathode-ray tube. The regulated supplies produce the necessary d-c voltages that are applied to the SA-84WA.

3-71. To facilitate an understanding of power distribution in the SA-84WA, reference should be made to figure 3-4. When power is initially applied to the unit, the tube filaments are energized. After a sixty-second warm-up period, time-delay relay, K602, operates and the regulated d-c voltages are applied to all the sub-chassis in the display unit, in the following sequence:

a. The klystron power supply provides power for the high frequency local oscillator in the tuning unit.

b. The +300 volt supply furnishes power for the Sweep Frequency Generator, the Video Amplifier, the R-F Tuning Unit and the CRT Power Supply.

c. The +125 volt supply furnishes power for the Wide Band and Narrow Band I-F Amplifiers, the Variable Bandwidth I-F Control Amplifier, the Sweep Frequency Generator, the Marker Oscillator, the Crystal Calibrator and the R-F Tuning Unit.

d. The -150 volt supply furnishes the bias voltages for the Video Amplifier and the Crystal Calibrator.

3-72. Paragraphs 3-73 through 3-78 describe the circuitry of all but the filament supply, which includes both a-c and d-c. They should be used in conjunction with the Power Distribution Diagram, figure 3-4.

3-73. KLYSTRON POWER SUPPLY. (See figure 5-3.) The anode supply is a conventional series-type degenerative voltage regulator consisting of the

series regulator V602, the control amplifier V603, and the voltage reference V604. The bias on the grid of the control amplifier V603 is adjusted by the -325 V Adjust control R609 to such a value that the voltage appearing at the plate (pin 1) of that tube is the bias voltage for the control grid of the series regulator V602 necessary to obtain the desired -325 volt output of the anode supply. Variations in the anode supply output voltage due to fluctuations in the load current or power line voltage are amplified by the control amplifier V603. The voltage change at the plate (pin 1) adjusts the bias voltage applied to the series regulator V602, which returns the output level of the anode supply to the desired -325 volts.

3-74. The reflector supply consists of a -408 volt supply comprised of the voltage reference tubes, V605, V606, and V607 connected in series in addition to the -325 volt (anode) supply. In this manner, the klystron supply simultaneously develops both of the negative potentials (733 volts and 325 volts) required for the operation of the high-frequency local oscillator V101.

3-75. +300 VOLT SUPPLY. (See figure 5-3.) The +300 volt supply is a conventional series-type degenerative voltage regulator consisting of the series regulator V609 and the control amplifier V614. The bias on the grid of the control amplifier V614 is adjusted by the +300 V Adjust control R638 to such a value that the voltage appearing at the plate (pin 1) of that tube is the bias voltage for the control grid of the series regulator V609 necessary to obtain the desired +300 volt output of the supply. Variations in the +300 volt supply output voltage due to fluctuations in the load current or power line voltage are amplified by the control amplifier V614. The voltage change at the plate (pin 1) adjusts the bias voltage applied to the grid of the series regulator V609, which returns the output level of the supply to the required +300 volts.

3-76. +125 VOLT SUPPLY. (See figure 5-3.) The +125 volt supply is a conventional series-type degenerative voltage regulator consisting of the series regulators V608 and V611 and the control amplifier V612. The bias on the grid of the control amplifier V612 is adjusted by the +125 V Adjust control R626 to such a value that the voltage appearing at the plate (pin 1) of that tube is the bias voltage for the control grids of the series regulators V608 and V611 necessary to obtain the desired +125 volt output of the supply. Variations in the +125 volt supply output voltage due to fluctuations in the load current or power line voltage are amplified by the control amplifier V612. The voltage change at the plate (pin 1) adjusts the bias voltage applied to the grids of the series regulators V608 and V611, which returns the output level of the supply to the desired +125 volts.

3-77. -150 VOLT SUPPLY. (See figure 5-3.) The -150 volt supply is a conventional series-type degenerative voltage regulator consisting of the series regulator V613, the voltage reference V615, and the control amplifier V620. The bias on the grid of the control amplifier V620 is adjusted by the -150 V Adjust control R659 to such a value that the voltage appearing at the plate (pin 1) of that tube is the bias voltage for the control grid of the series regulator V613 necessary to obtain the desired -150 volt output of the supply. Variations in the -150 volt supply output voltage due to fluctuations in the load current or power line voltage are amplified by the control amplifier V620. The voltage change appearing at the plate (pin 1) adjusts the bias voltage applied to the grid of the series regulator V613, which returns the output level of the supply to the desired -150 volts.

3-78. CRT SUPPLY. (See figure 5-4.) For the high-voltage low-current requirements of the cathode-ray tube, an r-f oscillator high-voltage supply is employed. High-frequency oscillations are developed in the Hartley-type circuit, the frequency of this oscillation being determined by the inductance of the entire primary winding of T603 and the capacitor C621. The output voltage appearing across the secondary of T603 (which is a step-up transformer) is applied to the high-voltage rectifiers V617 and V618, which are connected as a voltage doubler. The output of this network, which produces the +2, 400 and -2, 400 volts required, are applied to the various accelerating and control grids of the cathode-ray tube V619. A discharge resistor is provided across the positive 2, 400 volt supply as a means of quickly discharging the high-voltage when power is disconnected. The bleeder network in the negative 2, 400 volt supply permits adjustment of the various accelerating and control voltages applied to V619. This circuit arrangement also assures discharge of the high-negative voltage when the power is disconnected.

3-79. The front panel BRIGHTNESS control R663 maintains the control grid of the cathode-ray tube V619 at the proper negative potential with respect to the cathode. The front panel FOCUS control R667 adjusts the potential on grids 2 and 4, causing proper convergence of the electron beam on the screen of the cathode-ray tube. The accelerating anode is connected directly to the +2, 400 volt supply through P605.

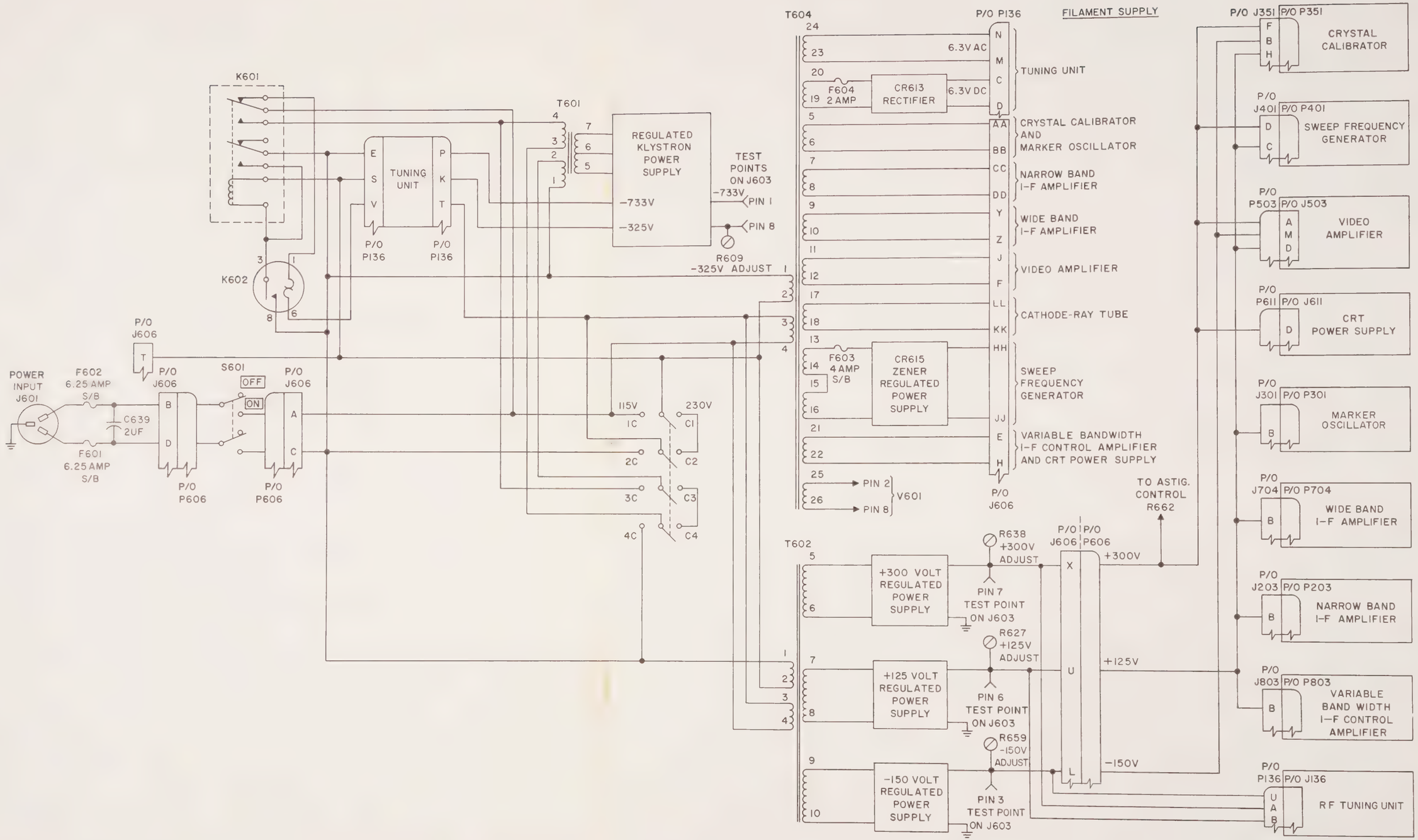


Figure 3-4. Power Distribution Diagram

SECTION IV

MAINTENANCE

4-1. GENERAL.

4-2. This section contains a list of the test equipment required for maintenance, the minimum performance standards that are used to ascertain equipment capability, the procedures for system and detailed troubleshooting, disassembly and reassembly instructions, alignment and calibration procedures, and lubrication data for the Model SA-84WA. Section V, Diagrams, contains schematic and cabling diagrams, and voltage and resistance tables to be used in conjunction with the procedures given in this section. Section VI, Parts List, contains a complete parts list for the Model SA-84WA.

4-3. TEST EQUIPMENT REQUIRED.

4-4. Table 4-1 lists and describes applications of test equipment required for Model SA-84WA maintenance. Test equipment of equivalent characteristics can be substituted for the items listed in the table.

4-5. MINIMUM PERFORMANCE STANDARDS.

4-6. Tables 4-2a and 4-2b list the minimum performance standards for the Model SA-84WA. The purpose of the minimum performance standards is to determine if the equipment is operating satisfactorily and is ready for use. Figure 4-1 is a block diagram showing waveshapes at specific points to aid in locating trouble. If excessive signal levels are required at any point, the trouble is between that point and the point previously checked.

4-7. SYSTEM TROUBLESHOOTING.

4-8. The system troubleshooting procedure for the Model SA-84WA is given in table 4-3. The procedure follows the normal operational sequence for the Model SA-84WA. The probable causes for the symptoms listed are given in the order of their probability of occurance.

4-9. DETAILED TROUBLE SHOOTING.

4-10. The detailed troubleshooting procedure for the Model SA-84WA is given in table 4-4. If the trouble has been localized to a single assembly or circuit during system troubleshooting, start the detailed troubleshooting at the step referenced in the table.

4-11. If the location of the trouble is indefinite or cannot be localized to a single assembly or circuit, start the detailed troubleshooting at the step that most closely resembles the trouble encountered.

4-12. Use the diagrams in Section V and the parts list in Section VI to supplement the detailed troubleshooting procedure of table 4-4.

4-13. DISASSEMBLY AND REASSEMBLY INSTRUCTIONS. (See figures 4-4 through 4-7.)

4-14. The Model SA-84WA should only be disassembled to the extent necessary to effect replacement or repairs.

4-15. DUST COVER REMOVAL. Access to all major assemblies and components mounted on the main chassis is obtained by removal of the dust cover. To remove the dust cover, proceed as follows:

a. At the rear of the dust cover, release the four fasteners by turning them a half-turn counterclockwise.

b. Grasp the handles on the tuning unit and pull the chassis out of the dust cover.

4-16. TUNING UNIT REMOVAL. Access to the components of the r-f tuning unit is obtained by removing it from the main chassis. To remove the unit, proceed as follows:

a. At the tuning unit front panel, rotate the four captive screws ccw until they are free.

b. Grasp the handles on the tuning unit and carefully manipulate the unit out of the main chassis.

c. The unit is electrically disconnected from the main chassis by removing receptacle P136 from its mating multi-pin connector J136, which is accessible at the rear-left section of the r-f tuning unit, and coaxial connectors J111, P118 and P128 from their mating connectors.

TABLE 4-1. TEST EQUIPMENT REQUIRED

Test Equipment Name, Model and Manufacturer	Application
Volt-ohm-milliammeter, Model 260, Simpson Electric Co.	Voltage and resistance measurements
Oscilloscope, Model 130B, Hewlett-Packard Co.	Checking waveforms and tuning unit
Voltmeter, vacuum-tube type, Model WV98A, Radio Corporation of America	Checking voltages at high impedance points
RF Signal Generator, Model 65B, Measurements Corp.	Checking narrow band i-f amplifier
RF Signal Generator, Model 80, Measurements Corp.	Checking the narrow band amplifier, sweep generator, i-f attenuator, and marker oscillator
RF Signal Generator, Model 612A, Hewlett-Packard Co.	Checking tuning unit
RF Signal Generator, Model 608C/D, Hewlett-Packard Co.	Checking tuning unit
RF Signal Generator, Model MSG-2R, Polarad Electronics Corp.	Checking tuning unit
Crystal Calibrator, Model 111B, Measurements Corp.	Checking the sweep generator
Frequency Counter, Model 524 with Converter, Model 525A, Hewlett-Packard Co.	Checking crystal calibrator
Sweep Generator, Model H3, Telonic Industries Inc.	Checking wide band amplifier
Bolometer Mount, Model 476A, Hewlett-Packard Co.	I-f attenuator calibration
Standing Wave Indicator, Model 415B, Hewlett-Packard Co.	I-f attenuator calibration
Wavemeters, Models N410A and H410A, FXR Inc.	Checking tuning unit
Klystron Mode Alignment Modulator, Model MK-1, Polarad Electronics Corp. (see figure 4-20.)	Checking tuning unit
Audio Oscillator, Series 200, Hewlett-Packard Co.	Checking video gain

TABLE 4-2a. MINIMUM PERFORMANCE STANDARDS

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
1	Determine whether power is being applied	Place ON-OFF switch in the ON position	POWER indicator illuminated; screen scale illuminated; blower fan on	Table 4-3, Step 1
2	Determine scale illumination variation	Rotate the SCALE ILLUM control through its full range	Screen scale illumination varies from off to maximum intensity	Table 4-3, Step 2
3	Determine whether crt display is operating	a. Rotate the VERT POS and the HOR POS controls through their full range	a. Sweep trace moves up or down and left or right	Table 4-3, Step 3
		b. Using the controls stated in a. above, position sweep trace so that it lies one inch below horizontal center and is vertically centered on screen. Adjust BRIGHTNESS and FOCUS controls for a sweep trace of suitable brightness and sharpness	b. Sweep trace is sharpened and retrace disappears	Table 4-3, Step 4
		c. Rotate the HOR GAIN control through its full range	c. Sweep length narrows or expands, depending on direction of rotation	Table 4-3, Step 5
		d. While applying a low-level signal to the DIRECT INPUT jack on the Rf Tuning Unit, rotate the VERT GAIN control through its full range	d. Pattern, height increases or decreases, depending on direction of rotation	Table 4-3, Step 6
		e. Set the HOR GAIN control for a four-inch wide trace. Rotate the SWEEP SPEED control through its full range	e. Sweep trace frequency varies from low frequency (1 cps) with flicker to high frequency (30 cps) without flicker	Table 4-3, Step 7
4	Check monitoring meter	a. Set METER SELECTOR control in REFLECTOR position	a. Pointer deflects to midscale, red shaded area marked VOLTS	Table 4-3, Step 8
		b. Set METER SELECTOR control in LINE position	b. Same as a. above	

(Cont'd)

TABLE 4-2a. MINIMUM PERFORMANCE STANDARDS (Cont'd)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
4	Check monitoring meter (Cont'd)	c. Set METER SELECTOR control in +125 position	c. Same as a. above	
		d. Set METER SELECTOR control in +300 position	d. Same as a. above	
		e. Set METER SELECTOR control in XTAL position	e. Pointer deflects on scale. Amount of deflection depends on setting of TUNING control	Table 4-3, Step 9
5	Determine whether marker oscillator is operating	a. Energize marker oscillator by rotating the MARKER AMPLITUDE control	a. Marker pip height varies from zero to maximum; also, height of pip is determined by setting of VERT GAIN control	Table 4-3, Step 10
		b. Rotate FREQUENCY DIFFERENCE -MCS TUNING control fully cw and ccw starting from "0" position	b. Marker pip moves from center to extreme left of screen and back through center to extreme right of screen	Table 4-3, Step 11
6	Checking crystal calibrator operation	Set the CRYSTAL CALIBRATOR-MC control in the 1, 10, 50, and 100 positions	Evenly spaced marker pips appear on the screen at each setting	Table 4-3, Step 12
7	Determine the characteristics of the DISPERSION control	Adjust the FREQUENCY DIFFERENCE MCS TUNING control until pip is centered on screen. Rotate the DISPERSION control through its full range	Width of marker pip varies	Table 4-3, Step 13
8	Determine the characteristics of the BANDWIDTH control	a. Apply a 160 mc cw signal to the IF INPUT connector. Rotate BANDWIDTH control fully cw (80 kc position)	a. A response curve as shown in figure 4-2 appears	Table 4-3, Step 14
		b. With the signal still being applied rotate the BANDWIDTH control fully ccw (1 kc position)	b. A nearly symmetrical reduction of the curve occurs. The resultant curve is shown in figure 4-3. The center line of the curve may move to the left slightly.	

(Cont'd)

TABLE 4-2a. MINIMUM PERFORMANCE STANDARDS (Cont'd)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
9	Determine the characteristics of the IF ATTENUATOR switches	Operate IF ATTENUATOR switches through their full range	The gain of the i-f signal on the screen varies accordingly	Table 4-3, Step 15
10	Determine the characteristics of the R.F. ATTENUATOR control	Rotate the R.F. ATTENUATOR control through its full range	Control affects signals in the 10 to 12,400 mc range only. Not less than 100 db attenuation should be indicated at the maximum cw setting	Table 4-3, Step 16

TABLE 4-2b. MINIMUM PERFORMANCE STANDARDS

Circuit	Input Signal	Applied To	Normal Vertical Deflection on CRT
Vertical Amplifier	1000 cps, 4.5 volts peak to peak	J502	10 cm.
Narrow Band	64 mc. (nominal) 30% modulation at 1000 cps 15 u V.	J201	2 cm.
Sweeper	160 mc. 25 u V	J404	2 cm.
Wide Band	160 mc. 2 u V.	J701	Signal plus Noise equal to Twice Noise

The above checks are made with the following panel control settings:

VERT GAIN	Maximum cw
BANDWIDTH	Maximum cw
DISPERSION HIGH-LOW	Low
DISPERSION CONTROL	Maximum cw
I-F ATTENUATOR	All steps OFF
LOG-FILTER-LIN switch	LIN
SWEEP SPEED	Maximum cw

TABLE 4-3. SYSTEM TROUBLESHOOTING

Step	Symptom	Probable Cause	Remedy
1	POWER indicator does not light when ON-OFF switch is set at ON	No ac power input	Check ac line
			Check power cord
			Check power cord connection to equipment
		Fuses F601 and/or F602 open	Replace defective fuses
		POWER indicator DS602 defective	Replace lamp in DS602
		ON-OFF switch S601 defective	Replace switch S601
		Component defective	Refer to table 4-4, step 1
2	Screen scale illumination is off or does not vary when SCALE ILLUM control is rotated	SCALE ILLUM control R646 is defective	Replace defective control
3	No sweep trace on screen	Cables are not connected to chassis.	Check for proper cable connections. See figure 5-5
		Component defective	Refer to table 4-4, step 3
4	Sweep trace is not affected when BRIGHTNESS and FOCUS controls are adjusted	BRIGHTNESS and FOCUS controls R663 and R667 respectively are defective	Replace controls R663 and R667
		Components defective	Refer to table 4-4, step 3
5	Sweep length fails to decrease or increase as the HOR GAIN control is rotated	HOR GAIN control R528B is defective	Replace control R528B
		Component defective	Refer to table 4-4, steps 4 and 5
6	Pattern height of applied signal is not affected by the rotation of the VERT GAIN control	VERT GAIN control R583B is defective	Replace control R583B
		Component defective	Refer to table 4-4, step 5
7	Sweep trace frequency does not vary when the SWEEP SPEED control is rotated	SWEEP SPEED CONTROL R505A is defective	Replace control R505A
		Component defective	Refer to table 4-4, step 6
8	Pointer of Monitoring Meter fails to deflect to red area when METER SELECTOR control is set in REFLECTOR, LINE, +125, +300, position	Monitoring Meter M101 is defective	Replace meter M101
		METER SELECTOR control is defective	Replace control S101
		Component defective	Refer to table 4-4, step 7

(Cont'd)

TABLE 4-3. SYSTEM TROUBLESHOOTING (Cont'd)

Step	Symptom	Probable Cause	Remedy
9	Pointer of Monitoring Meter remains stationary when METER SELECTOR control is set in XTAL position	Monitoring Meter M101 is defective	Replace meter M101
		METER SELECTOR control is defective	Replace control S101
		Component defective	Refer to table 4-4, step 7
10	No marker pip or marker pip remains at a set height when rotating the MARKER AMPLITUDE control	MARKER AMPLITUDE control R305 and/or switch S301 are defective	Replace control R305 and/or switch S301
11	Marker pip does not move when the FREQUENCY DIFFERENCE MCS TUNING control is rotated	FREQUENCY DIFFERENCE MCS TUNING control C306 is defective	Replace control C306
12	Width of marker pip does not change when the DISPERSION control is rotated	DISPERSION control R538 is defective	Replace control R538
		Component defective	Refer to table 4-4, step 6
13	Evenly spaced marker pips fail to appear on the screen when the CRYSTAL CALIBRATOR MC control is set in the 1, 10, 50, and 100 positions	CRYSTAL CALIBRATOR MC control S604 is defective	Replace control S604
		Component defective	Refer to table 4-4, step 10
14	Response curves as shown in figures 4-2 and 4-3 are not present when the BANDWIDTH control is placed in the extreme cw and ccw positions, respectively	BANDWIDTH control R804 is defective	Replace control R804
		Component defective	Refer to table 4-4, step 11
		Variable resolution amplifier is misaligned	Align variable resolution amplifier (see paragraph 4-30)
15	Gain of i-f signal displayed on screen remains constant when one or more steps of the IF ATTENUATOR-DB control are operated	Switches S275 through S279 are defective	Replace defective Switch(es)
		Component defective	Refer to table 4-4, step 12
16	No effect is evidenced when rotating the R.F. ATTENUATOR control	Input signal is above or below the frequency range of 10 to 12, 400 mc	
		R.F. ATTENUATOR control, consisting of AT101 and/or AT102, is defective	Replace AT101 and/or AT102

TABLE 4-4. DETAILED TROUBLESHOOTING

Step	Trouble	Troubleshooting Procedure
1	Power input circuit open	Check continuity of transformer T604, terminals 1-2 and 3-4 (see figure 5-3)
2	Rf tuning unit fails to operate	Check relay K601 and time delay relay K602 using Model WV98A voltmeter
		Check transformer T601 for continuity (see figure 5-3)
		Check rectifier tube V601
		Check capacitor C601 for short using Model 260 multimeter
		Check transformer T602 for continuity (see figure 5-3)
		Check rectifiers CR609 through CR612
		Check tubes V602, V603, V604, V605, V606, and V607 and associated circuitry.
		Check tubes V613, V615, and V620 and associated resistors and capacitors (see figure 5-3) using Model 260 multimeter
		Check rectifiers CR601 through CR604
		Check capacitors C606 and C607A for shorts using Model 260 multimeter
		Check and adjust, if required, control R627 using Model 260 multimeter. (see paragraph 4-24) Measurement and adjustment are made at the rear of main chassis (see figure 4-4)
		Check tubes V608, V611, and V612 and associated resistors and capacitors using Model 260 multimeter
		Check rectifiers CR605 through CR608
		Check capacitor C612 for short using Model 260 multimeter
		Check and adjust, if required, control R638 using Model 260 multimeter. (see paragraph 4-24) Measurement and adjustment are made at the rear of main chassis (see figure 4-4)
		Check tubes V609, and V614 and associated resistors and capacitors using Model 260 multimeter

(Cont'd)

TABLE 4-4. DETAILED TROUBLESHOOTING (Cont'd)

Step	Trouble	Troubleshooting Procedure
3	Low intensity of spectrum or no trace	Check transformer T603 for continuity (see figure 5-4) Check tubes V616, V617 and V618 and associated resistors and capacitors using Model 260 multimeter
4	HOR GAIN and HOR POS control do not affect trace	Check tube V505 and associated resistors and capacitors using Model 260 multimeter
5	VERT GAIN and VERT POS controls do not affect trace	Check amplifier tubes V508 and V509 and associated resistors and capacitors using Model 260 multimeter
6	DISPERSION AND SWEEP SPEED control do not affect trace	Check relay K501 for dirty contacts Check sawtooth generator tubes V501 and V502 and associated resistors and capacitors using Model 260 multimeter
7	Monitoring Meter fails to indicate when METER SELECTOR control is set in XTAL position	Check local oscillators V102 and V103 and associated resistors and capacitors using Model 260 multimeter Check crystal CR102, CR103 Check switches S101 and S102 for dirty contacts Check coaxial relays K103 and K104 for continuity Check local oscillator V101 (see paragraph 4-32)
8	MARKER AMPLITUDE control does not affect trace	Check marker oscillator V301 and associated resistors and capacitors using Model 260 multimeter
9	CENTER FREQUENCY control does not affect marker pip	Check sweep frequency generator tubes V403, V405, V406, V408 and V409 and associated resistors and capacitors using Model 260 multimeter Check controls R585 and R587 (see figure 4-7)
10	Marker pips fail to appear when the CRYSTAL CALIBRATOR MC control is set in any position	Check tubes V351 through V355 and associated resistors and capacitors using Model 260 multimeter (see figure 5-2)

(Cont'd)

TABLE 4-4. DETAILED TROUBLESHOOTING (Cont'd)

Step	Trouble	Troubleshooting Procedure
11	Display on crt screen fails to reduce symmetrically when the BANDWIDTH control is rotated from maximum cw to maximum ccw position	Check tubes V801 and V802 and associated resistors and capacitors using Model 260 multimeter and tuning Check narrow band i-f amplifier tubes V201 through V205 and associated resistors and capacitors using Model 260 multimeter and tuning
12	IF ATTENUATOR control does not affect trace	Check attenuator resistor network R275 through R293 using Model 260 multimeter (see figure 5-2)

4-17. KLYSTRON REMOVAL. To remove the klystron V101, proceed as follows:

Note

Before removing the klystron tube refer to paragraph 4-32.

a. Loosen the strap clamp that secures the klystron cover.

b. Separate the cover from the klystron base by gently pulling the cover back along the socket lead cable.

c. Gently pull the tube socket assembly away from the base of the klystron tube.

d. Loosen the klystron retainer nut with the spanner wrench provided. One-half turn counterclockwise is sufficient to release the klystron. Do not remove the nut.

e. Grasp the projecting end of the klystron tube, gently rotating it in a clockwise direction while simultaneously withdrawing the tube from its spring-finger holders within the cavity.

4-18. KLYSTRON REPLACEMENT. To replace the klystron V101, proceed as follows:

a. Insert the replacement klystron in the cavity. A noticeable resistance will be felt, due to the spring fingers within the cavity, as the klystron is inserted. Give the klystron a slight clockwise twist as it is inserted, and push it into the cavity until a positive stop is encountered.

b. Tighten the klystron retainer nut with the spanner wrench provided.

c. Mate the klystron socket and klystron base pins. Be sure that the pins and socket are properly mated.

d. Slide the klystron cover over the socket until the cover is over the retaining nut and tighten the strap clamp.

Note

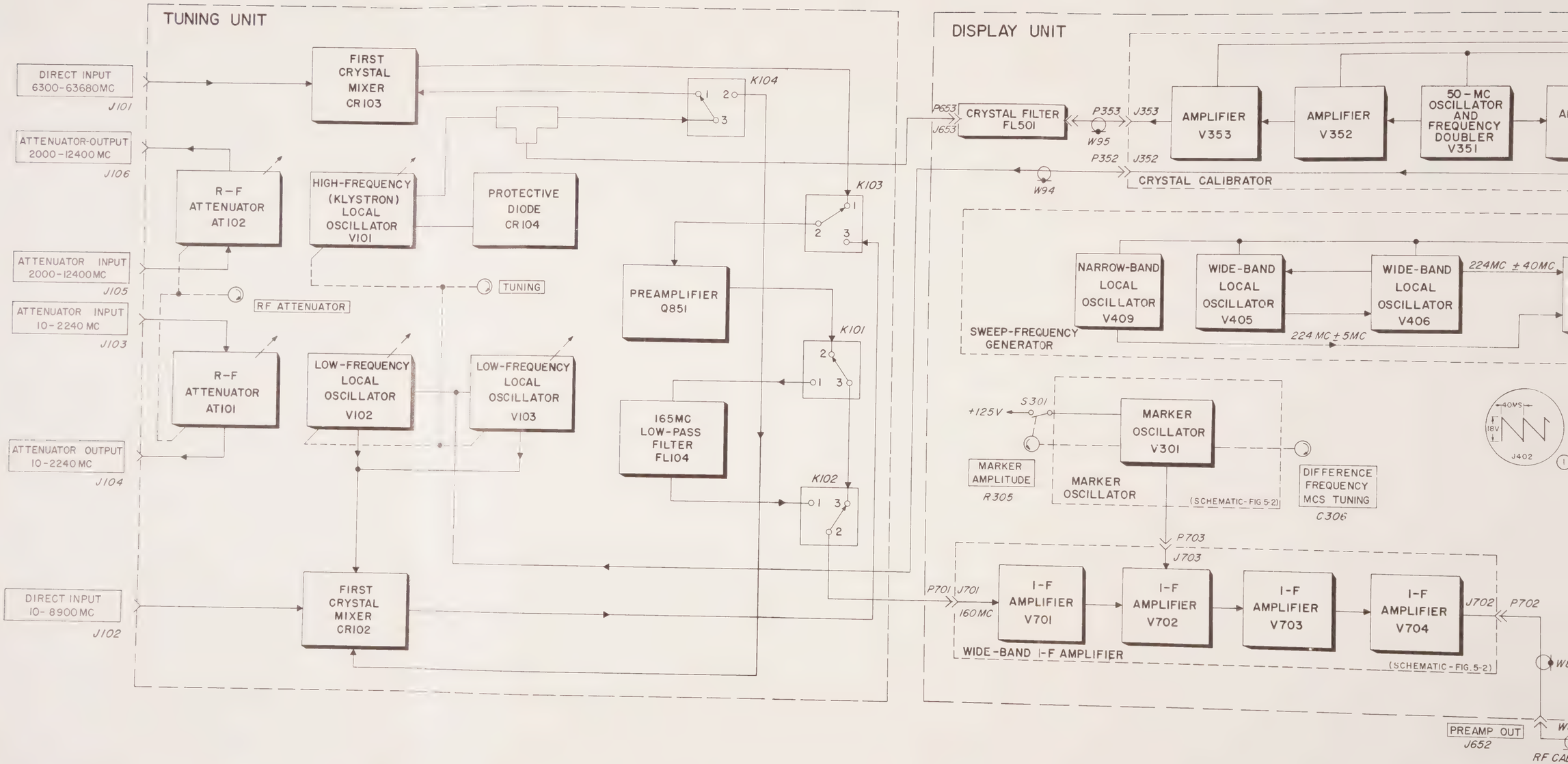
The procedure of paragraphs 4-32 and 4-33 must be performed after klystron replacement.

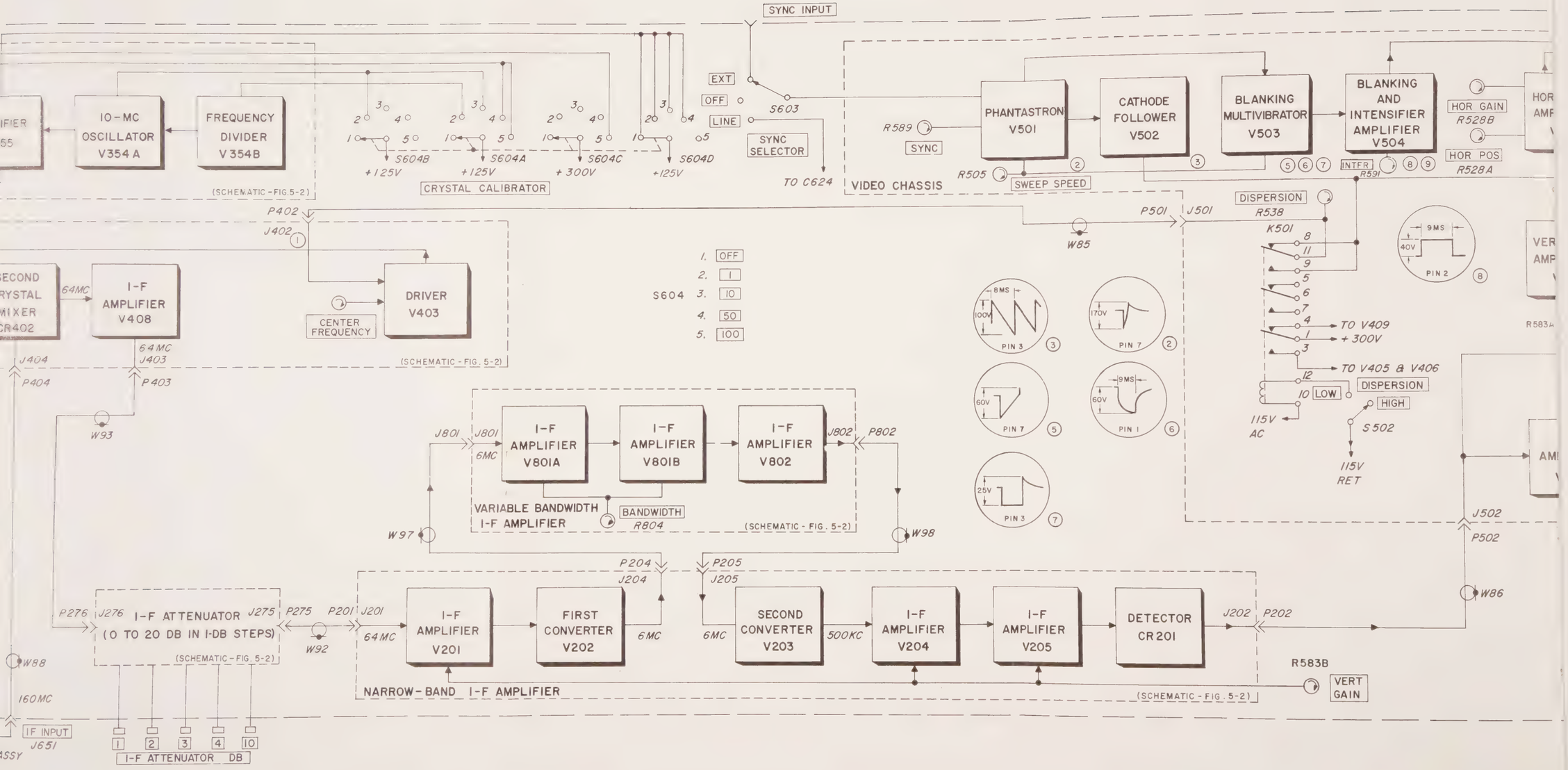
4-19. TUNING UNIT REPLACEMENT. To replace the r-f tuning unit, proceed as follows:

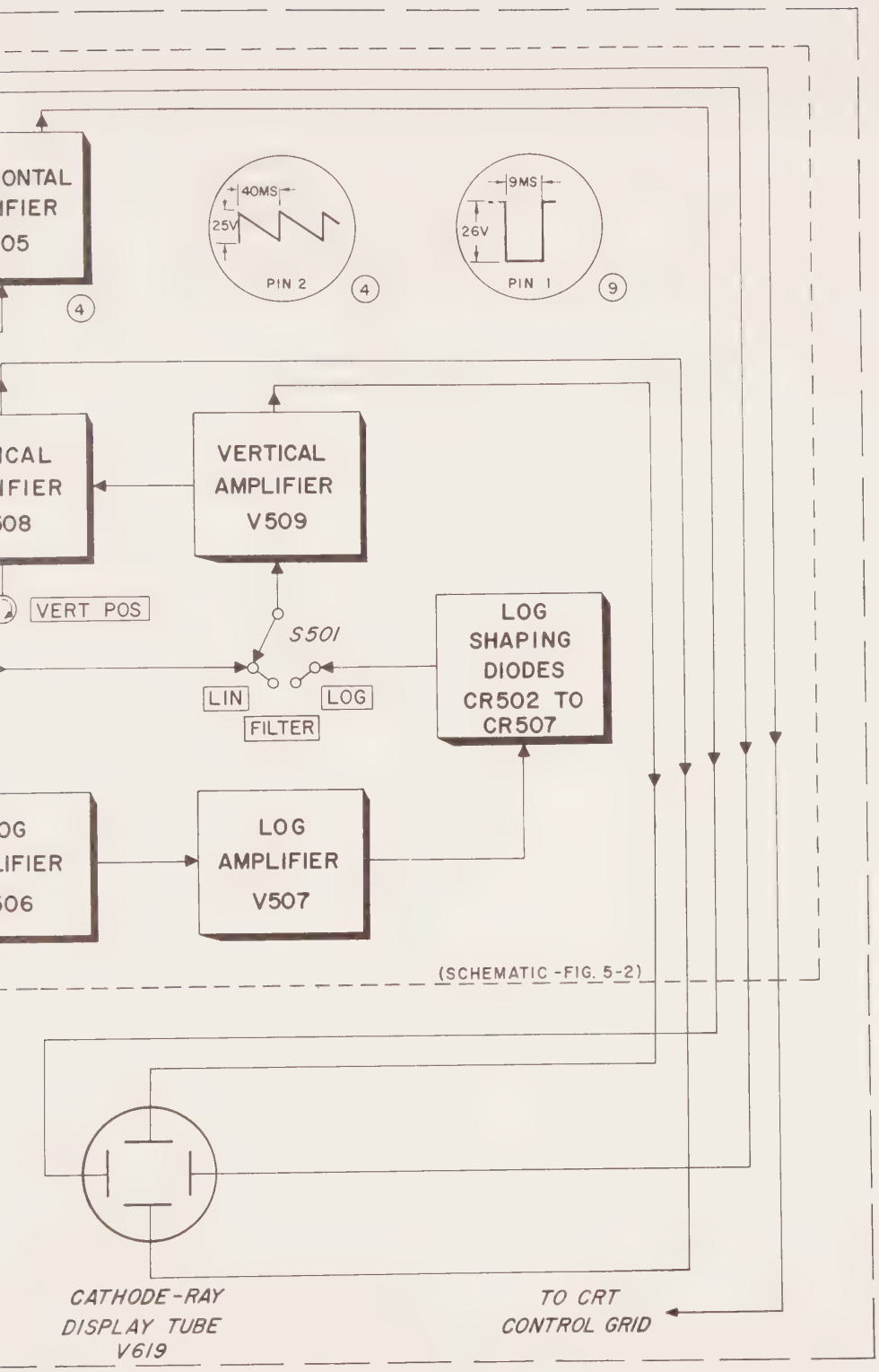
a. Connect receptacle P136 to its mating multipin connector J136, and coaxial connectors P131, P655, and P656 to their mating connectors as indicated by the color dot painted on each connector.

b. Grasp the handles on the tuning unit and carefully manipulate the unit into the main chassis.

c. Engage and tighten the four captive screws.


TUNING UNIT
DISPLAY UNIT
DIRECT INPUT 6300-63680MC
J101
ATTENUATOR-OUTPUT 2000-12400 MC
J106
ATTENUATOR INPUT 2000-12400MC
J105
ATTENUATOR INPUT 10-2240 MC
J103
ATTENUATOR OUTPUT 10-2240MC
J104
DIRECT INPUT 10-8900MC
J102
FIRST CRYSTAL MIXER CR103
K104
R-F ATTENUATOR AT102
HIGH-FREQUENCY (KLYSTRON) LOCAL OSCILLATOR V101
PROTECTIVE DIODE CR104
K103
TUNING
RF ATTENUATOR
PREAMPLIFIER Q851
K101
R-F ATTENUATOR AT101
LOW-FREQUENCY LOCAL OSCILLATOR V102
LOW-FREQUENCY LOCAL OSCILLATOR V103
165MC LOW-PASS FILTER FL104
K102
FIRST CRYSTAL MIXER CR102
P653
J653
CRYSTAL FILTER FL501
P353
J353
W95
P352
J352
AMPLIFIER V353
AMPLIFIER V352
50-MC OSCILLATOR AND FREQUENCY DOUBLER V351
W94
CRYSTAL CALIBRATOR
NARROW-BAND LOCAL OSCILLATOR V409
WIDE-BAND LOCAL OSCILLATOR V405
WIDE-BAND LOCAL OSCILLATOR V406
224MC ± 40MC
224 MC ± 5MC
SWEEP-FREQUENCY GENERATOR
+125V
S301
MARKER OSCILLATOR V301
MARKER AMPLITUDE R305
MARKER OSCILLATOR
(SCHEMATIC-FIG 5-2)
DIFFERENCE FREQUENCY MCS TUNING C306
40MS
18V
J402
P703
J703
P701
J701
160MC
I-F AMPLIFIER V701
I-F AMPLIFIER V702
I-F AMPLIFIER V703
I-F AMPLIFIER V704
J702
P702
WIDE-BAND I-F AMPLIFIER
(SCHEMATIC-FIG. 5-2)
PREAMP OUT
J652
RF CA


SYNC INPUT
EXT
OFF
LINE
S603
SYNC SELECTOR
TO C624
10-MC OSCILLATOR V354A
FREQUENCY DIVIDER V354B
(SCHEMATIC - FIG. 5-2)
S604B +125V
S604A +125V
S604C +300V
S604D +125V
CRYSTAL CALIBRATOR
VIDEO CHASSIS
R589 SYNC
PHANTASTRON V501
CATHODE FOLLOWER V502
BLANKING MULTIVIBRATOR V503
BLANKING AND INTENSIFIER AMPLIFIER V504
R505 SWEEP SPEED
INTER R591
HOR GAIN R528B
HOR POS R528A
P402
J402
P501
J501
W85
DISPERSION R538
K501
TO V409
+300V
TO V405 & V406
DISPERSION
LOW
HIGH
S502
115V AC
115V RET
S604 1. OFF 2. 1 3. 10 4. 50 5. 100
64MC
I-F AMPLIFIER V408
DRIVER V403
CENTER FREQUENCY
J404
P404
64MC J403
P403
W93
J801
6MC
I-F AMPLIFIER V801A
I-F AMPLIFIER V801B
I-F AMPLIFIER V802
J802
P802
VARIABLE BANDWIDTH I-F AMPLIFIER
BANDWIDTH R804
(SCHEMATIC - FIG. 5-2)
W97
W98
P204
J204
P205
J205
P276
J276
I-F ATTENUATOR (0 TO 20 DB IN 1-DB STEPS)
J275
P275
P201
J201
W92
(SCHEMATIC - FIG. 5-2)
64MC
I-F AMPLIFIER V201
FIRST CONVERTER V202
6MC
6MC
SECOND CONVERTER V203
500KC
I-F AMPLIFIER V204
I-F AMPLIFIER V205
DETECTOR CR201
J202
P202
W86
P502
J502
R583B
VERT GAIN
NARROW-BAND I-F AMPLIFIER
(SCHEMATIC - FIG. 5-2)
W88
160MC
IF INPUT J651
1 2 3 4 10
I-F ATTENUATOR DB
8MS 100V PIN 3
170V PIN 7
60V PIN 7
9MS 60V PIN 1
25V PIN 3
9MS 40V PIN 2



ure 4-1. Block Diagram Showing Signal Levels

TABLE 4-4.

Step	Troubl
11	Display on crt screen symmetrically when control is rotated fr to maximum ccw pos
12	IF ATTENUATOR cont affect trace

4-17. KLYSTRON REMOVAL. To remove tron V101, proceed as follows:

Note

Before removing the klystron tube refer paragraph 4-32.

a. Loosen the strap clamp that secures tron cover.

b. Separate the cover from the klystron gently pulling the cover back along the sock cable.

c. Gently pull the tube socket assembly the base of the klystron tube.

d. Loosen the klystron retainer nut with spanner wrench provided. One-half turn cc clockwise is sufficient to release the klystr not remove the nut.

e. Grasp the projecting end of the klystr gently rotating it in a clockwise direction wh taneously withdrawing the tube from its spri holders within the cavity.

4-18. KLYSTRON REPLACEMENT. To re klystron V101, proceed as follows:

a. Insert the replacement klystron in the A noticeable resistance will be felt, due to th fingers within the cavity, as the klystron is i

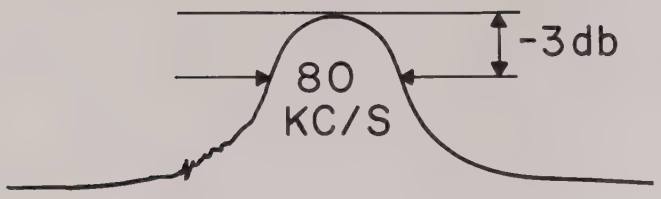


Figure 4-2. Response Curve for Variable Bandwidth I-F Control Amplifier with Bandwidth Control Set Fully Cw (80 kc Position)

Figure 4-3. Response Curve for Variable Bandwidth I-F Control Amplifier with Bandwidth Control Set Fully Ccw (1 kc Position)

4-20. DUST COVER REPLACEMENT. To replace the dust cover, proceed as follows:

a. Slide the main chassis into the dust cover.

b. Lock the four fasteners at the rear of the dust cover by turning them a half-turn clockwise.

4-21. ALIGNMENT AND CALIBRATION PROCEDURES.

4-22. The alignment and calibration of Model SA-84WA require the test equipment listed in Table 4-1. The complete alignment and calibration of Model SA-84WA involve the procedures given in paragraphs 4-23 through 4-37, which must be performed in the order given, except for the procedures of paragraphs 4-32 through 4-34 which can be performed independently after tube replacement.

4-23. POWER SUPPLIES. The power consists of a negative supply of 733 and 325 volts for the klystron, a positive supply of 300 volts, a positive supply of 125 volts and a negative bias supply of 150 volts for the display unit. It also includes a positive 2400 volts and negative 2400 volts supply for the cathode-ray tube and both a-c and d-c filament supplies.

4-24. The outputs of the various supplies, with the exception of the high voltage cathode-ray tube and filament supplies, are available for test at J603 (figure 4-4) located at the rear of the main chassis. Controls R609, R627, R638, R659, and R662 are provided for adjusting the output potentials of the electronically regulated supplies. For this test procedure, clip leads can be removed from the ends of the voltmeter test prods, since readings can be safely obtained by inserting the voltmeter test prods into the appropriate pins provided on J603. Moreover, it is unnecessary to turn the power off between tests, providing care is exercised in handling the test equipment. With the power switched to ON and after allowing a 60 second delay for the delay-relay to energize, perform the following tests and adjustments, making all measurements with respect to ground:

a. Pins 1 and 8 (proceeding counterclockwise from the keyway of the socket) are test points for the negative 325 and 733 volt klystron supply. Adjust R609 for -325V from pin 8 to ground. These potentials are mutually dependent upon each other; the inability to obtain a normal reading of one supply will usually adversely affect the other.

b. Pin 3 is the test point for the negative bias supply of 150 volts. Adjust R659 for the correct operating potential. Abnormal indication at pin 3 will usually be accompanied by abnormal indications at pins 6 and 7 since these are dependent upon the negative 150 volt reference.

c. Pins 6 and 7 are test points for the positive supplies for the display unit. Adjust R627 and R638 to obtain readings of +125 volts and +300 volts respectively. These readings will only be obtainable if the reading previously observed at pin 3 was minus 150 volts.

4-25. WIDE BAND I-F AMPLIFIER. To check the wide band i-f amplifier gain and frequency response, set up the equipment as shown in figure 4-8. Measure the gain of the amplifier over the pass band from 120 to 200 mc. A gain of approximately 25 db at 160 mc indicates satisfactory equipment performance. Failure to obtain this indication shows the need for re-alignment. Proceed as directed in the following steps:

a. Peak coils L701 through L707 to obtain the response curve,shown in figure 4-9.

b. Check the response for a nominal bandwidth of 80 mc (about a center frequency of 160 mc) with a maximum amplitude variation of 3 db over this bandwidth.

c. Disconnect test setup and reconnect cables to J701 and J702.

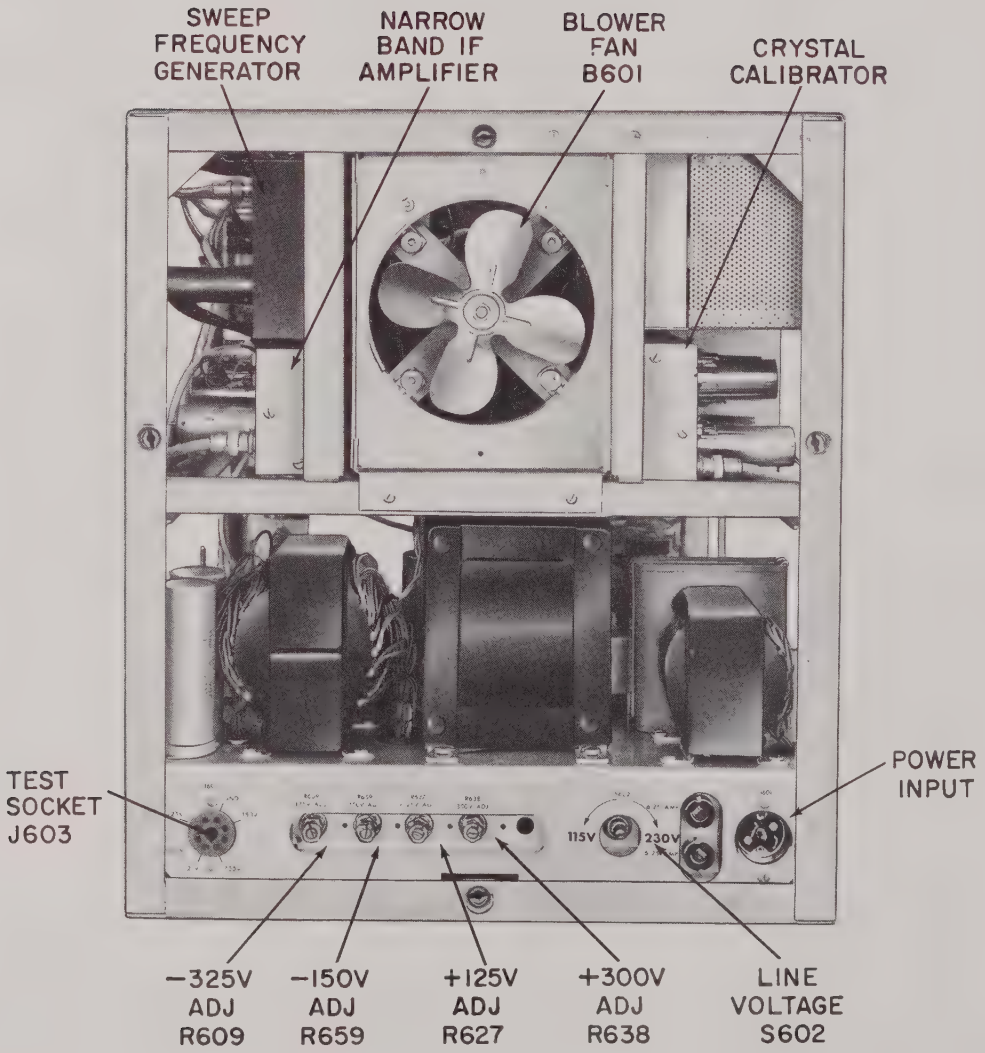


Figure 4-4. Rear View of Spectrum Analyzer

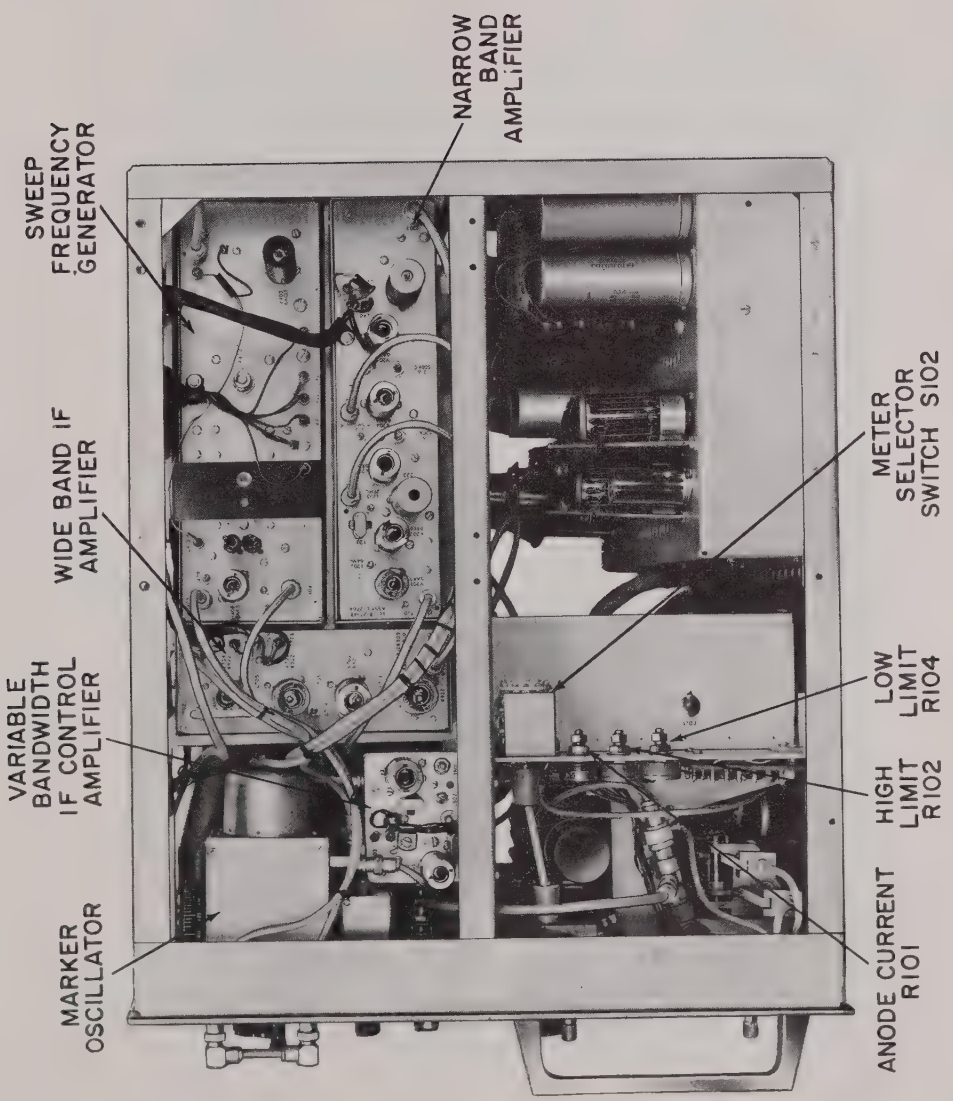


Figure 4-5. Right Side View of Spectrum Analyzer

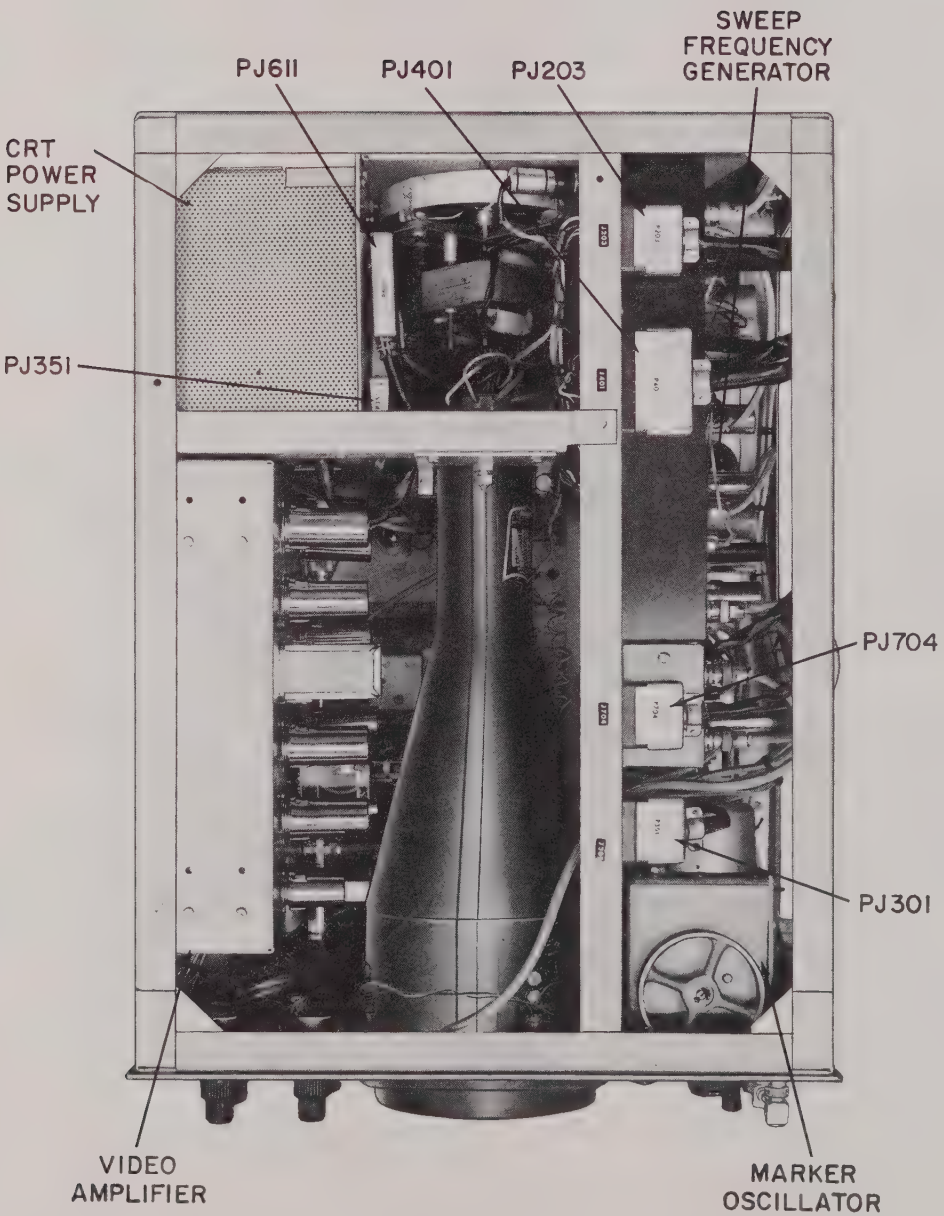


Figure 4-6. Top View of Spectrum Analyzer

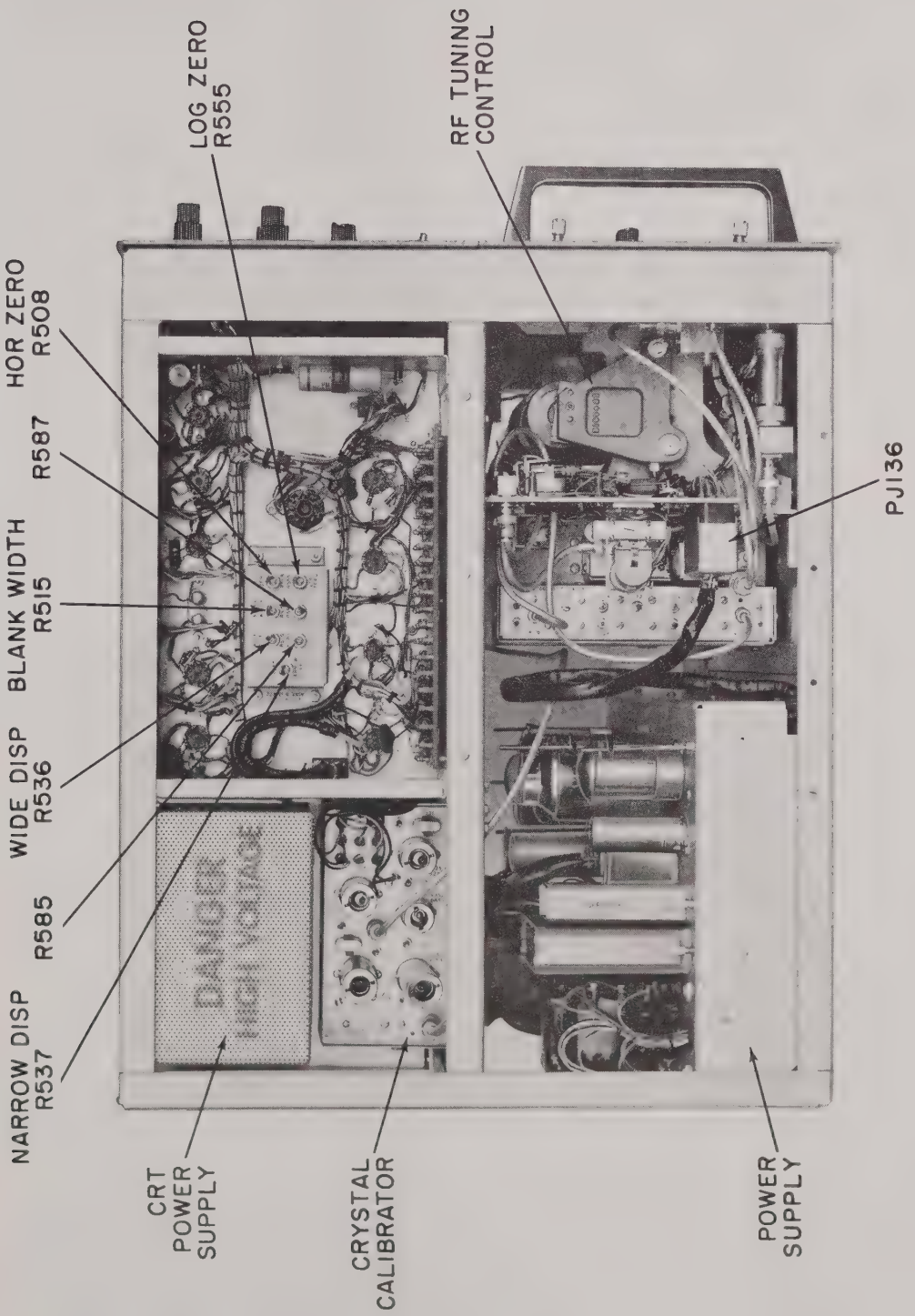


Figure 4-7. Left Side View of Spectrum Analyzer

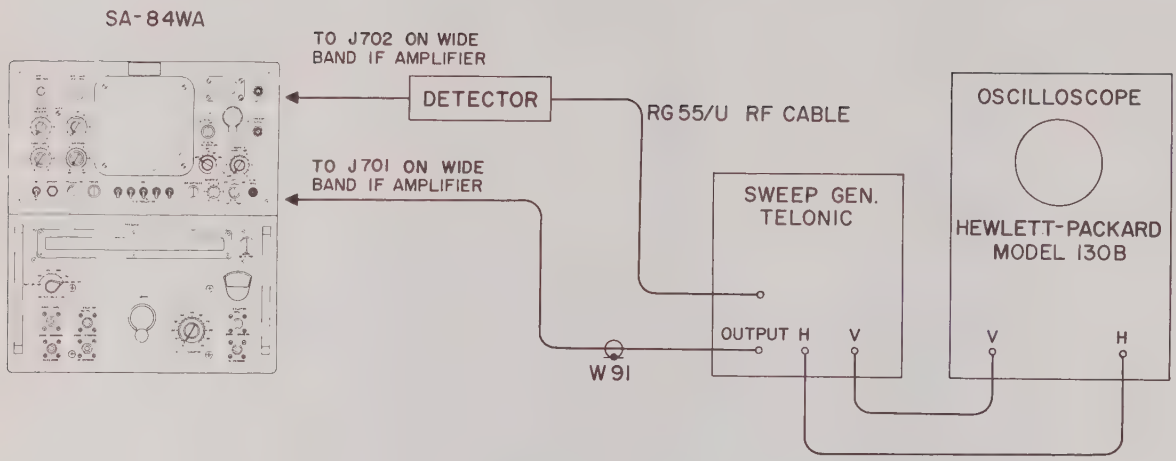


Figure 4-8. Test Setup for Checking and Aligning the Wide Band I-F Amplifier

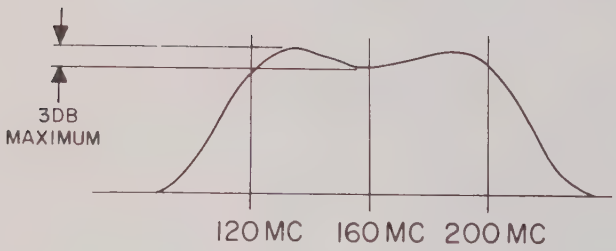


Figure 4-9. Typical Response Curve of the Wide Band I-F Amplifier

4-26. CRYSTAL CALIBRATOR. The crystal calibrator provides for the injection of 1, 10, 50, or 100 mc markers into the spectrum display. The amplitude of these markers should be such that they are readily visible on the crt. To adjust the crystal calibrator for optimum results, set up the equipment as shown in A, figure 4-10, and proceed as follows:

a. Set the CRYSTAL CALIBRATOR control to 10 MC.

b. Adjust L354 for maximum amplitude of the markers on the crt.

c. Set the CRYSTAL CALIBRATOR control to 1 MC.

d. Set the DISPERSION control to 10 mc.

e. Adjust L355 until 11 sharp undistorted markers spaced at 1 mc intervals appear on the crt.

f. Set the CRYSTAL CALIBRATOR control to 50 MC.

g. Adjust L351 until the marker locks in on 150 and 200 mc on the crt.

h. Adjust L352 for maximum amplitude of the markers on the crt.

i. Connect the frequency counter with its converter to J352 as shown in B, figure 4-10.

j. Set the CRYSTAL CALIBRATOR control to 10 MC.

k. Adjust C376 for 10 MC.

l. Set the CRYSTAL CALIBRATOR control to 50 MC.

m. Adjust L351 for 50 MC.

n. Connect the multimeter from C370 to ground.

o. Set CRYSTAL CALIBRATOR control to 100 MC.

p. Adjust L353 and C365 for maximum d-c voltage on the multimeter.

4-27. SWEEP FREQUENCY GENERATOR. The sweep frequency generator converts the sawtooth output of the phantastron generator into a swept frequency signal centered at 224 mc. A deviation in linearity of the signal indicates that the sweep frequency generator needs alignment. To align the sweep frequency generator, proceed as follows:

a. Set up the equipment as shown in figure 4-11.

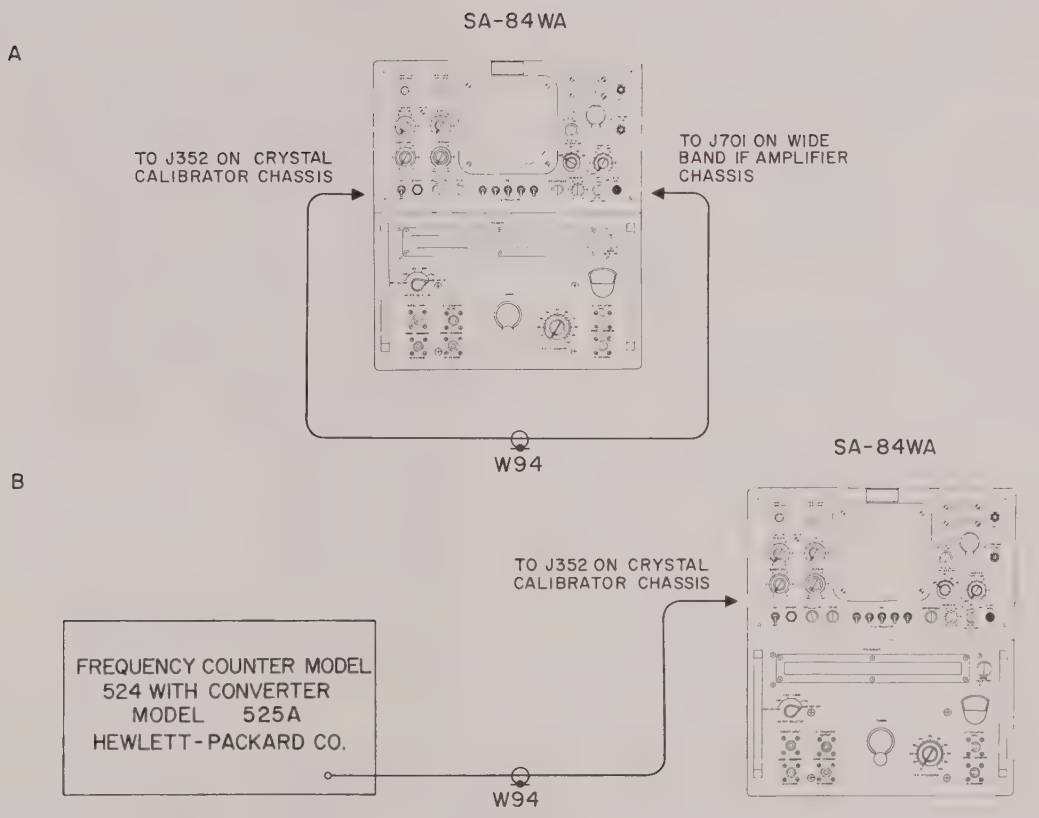


Figure 4-10. Test Setup for Checking and Aligning the Crystal Calibrator

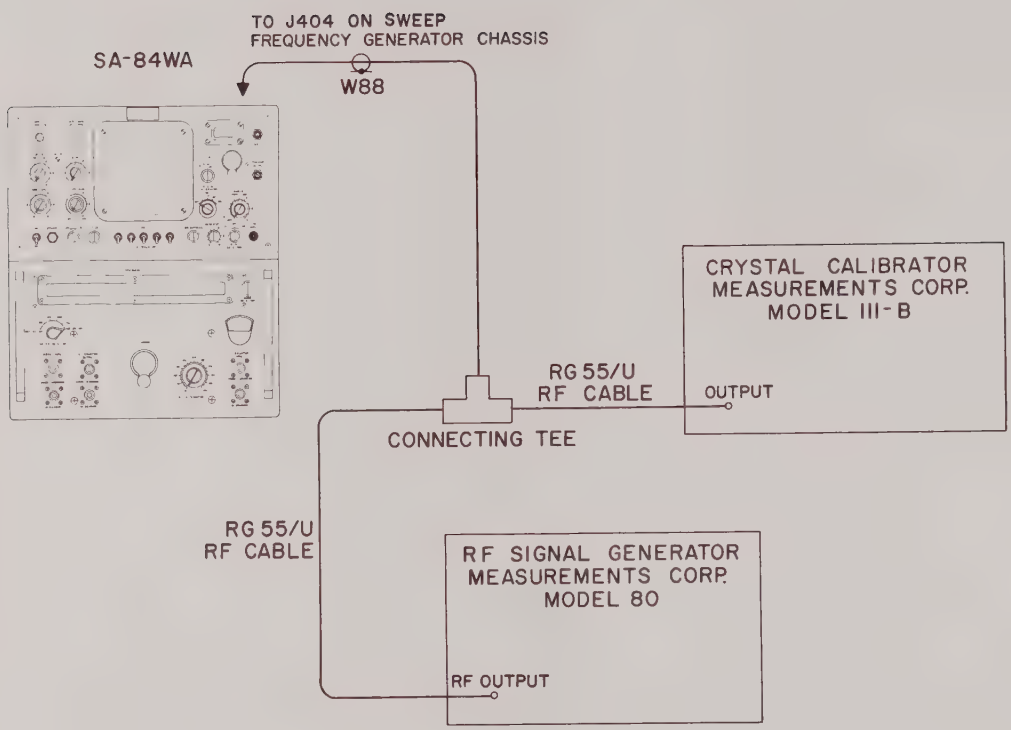


Figure 4-11. Test Setup for Checking and Aligning the Sweep Frequency Generator

b. Tune the Model 80 to 160 mc and set the DISPERSION switch at High.

c. Adjust L408 and L409 (figure 4-6) for maximum deflection on the crt.

d. Set the Model 111-B for 10 mc markers.

e. Adjust R403 and the CENTER FREQUENCY control for best frequency linearity and proper frequency range as shown in figure 4-12, taking special note of track foldover.

f. With the CENTER FREQUENCY control adjusted for 160 mc in the center of the trace set the DISPERSION switch to Low.

g. Set the Model 111-B to 1 mc markers.

h. Adjust L406 for best linearity with 160 mc at the center of the trace.

i. Disconnect test setup and reconnect cable to J404.

4-28. NARROW BAND I-F AMPLIFIER. To check the narrow band i-f amplifier, use the test setup of

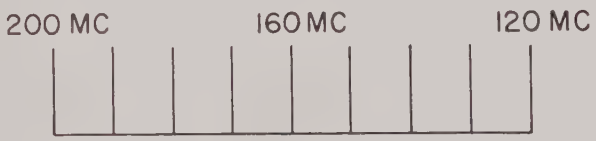


Figure 4-12. Typical Response Curve of the Sweep Frequency Generator

B, figure 4-13. Measure the sensitivity of the amplifier at 64 mc for a 2 cm deflection on the crt, which should be obtained with 150 microvolts input. Failure to obtain the required deflection shows the need for re-alignment. Proceed as follows:

a. Set up the test equipment as shown in A, figure 4-13.

b. Set the DISPERSION control at Low.

c. Couple the Model 65B to J205 as shown in figure 4-13. Tune to exactly 500 kc with 30 percent 1000 cps modulation.

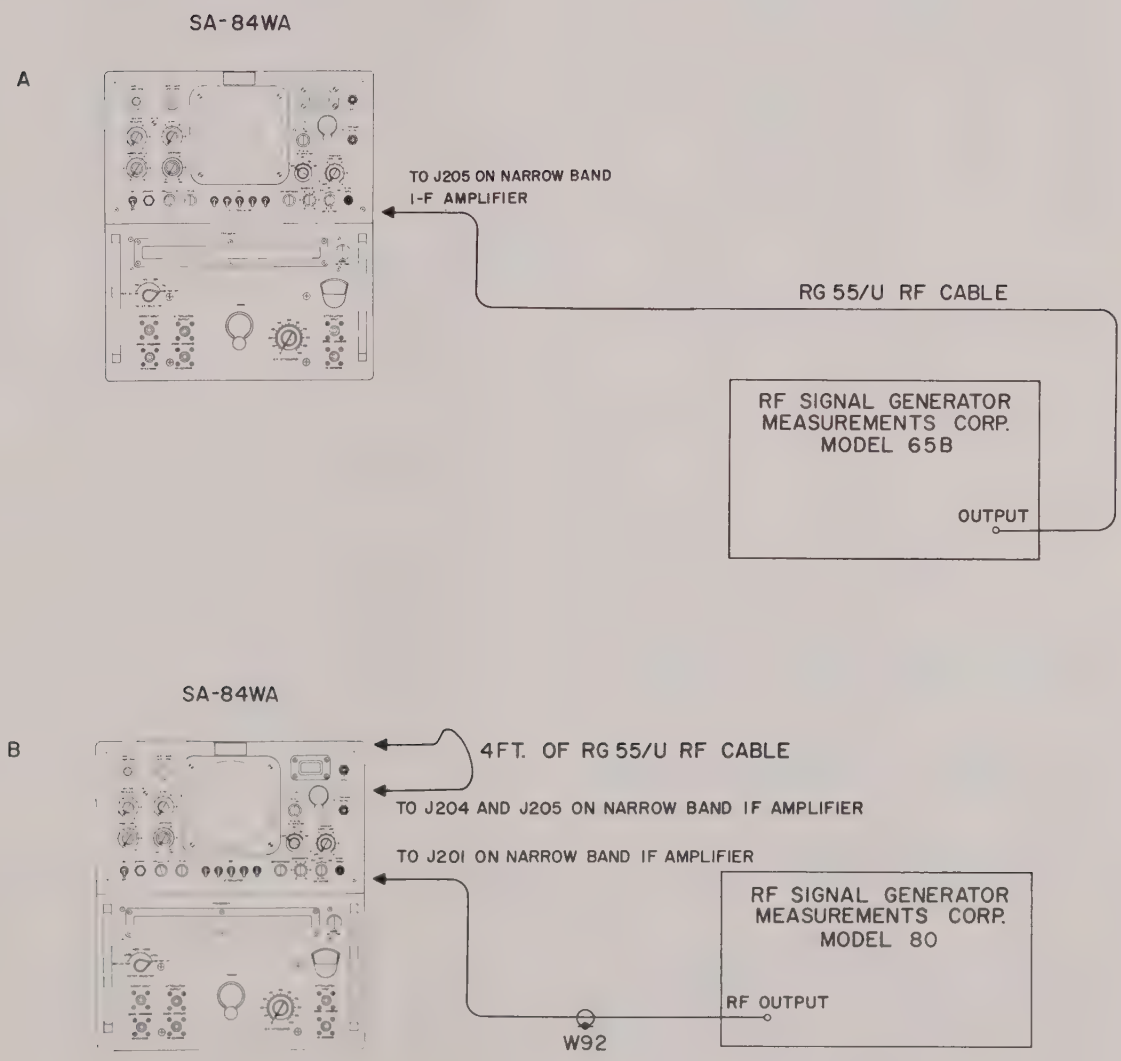


Figure 4-13. Test Setup for Checking and Aligning the Narrow Band I-F Amplifier

d. Adjust L209, L216, L219 (figure 4-5) for maximum display on the crt.

e. Tune the Model 65B to exactly 6.0 mc with 30 percent, 1000 cps modulation.

f. Adjust L213, for maximum display on the crt.

g. Connect the Model 80 to J201 as shown in B, figure 4-13. Tune to 64 mc with 30 percent, 1000 cps modulation.

h. Adjust L225, L205, L202, T201 for maximum display on the crt.

i. Check the sensitivity of the amplifier for 2 cm of deflection with 150 microvolts input.

j. Disconnect the test setup and reconnect the cables to J205, J204, and J201.

4-29. MARKER OSCILLATOR. To check the performance of the marker oscillator circuit, observe the marker pip on the display of the spectrum analyzer and proceed as follows:

a. Connect the Model 80 and the Model 111-B to J701 of the wide band i-f amplifier, as shown in figure 4-14.

b. Tune the Model 80 to 200 mc and the Model 111-B for 10 mc markers.

c. Observe the screen of the crt to locate the 120, 160, and 200 mc crystal markers.

d. Use a wax marking pencil to inscribe the location of the 120 and 200 mc markers on the crt screen.

e. Rotate the CRYSTAL CALIBRATOR MC control to 1 and mark the location of the 122 and 118 mc markers.

f. Rotate the MARKER AMPLITUDE control to its approximate mid-position. Set the control to obtain a convenient height of the signal pip.

g. Vary the marker oscillator TUNING control for a reading of minus 40 mc on the FREQUENCY DIFFERENCE MCS dial.

h. If the marker oscillator pip falls between the 118 and 122 mc markers, the marker oscillator circuit is operating satisfactorily at the low end of its frequency excursion.

i. Vary the marker oscillator TUNING control for a reading of plus 40 mc on the FREQUENCY DIFFERENCE MCS dial.

j. If the marker oscillator pip falls between the 198 and 202 mc markers, the marker oscillator circuit is also operating satisfactorily at the high end of its frequency excursion.

k. In the event that the alignment error of the marker oscillator is greater than 2.0 mc, realignment will be required. Proceed as follows:

(1) Tune the FREQUENCY DIFFERENCE MCS dial to a reading of plus 40 mc.

(2) Adjust L305 (figure 4-5) until the marker oscillator pip coincides with the plus 40 mc marker.

(3) Tune the FREQUENCY DIFFERENCE MCS dial to a reading of minus 40 mc.

(4) Simultaneously adjust C303 and C304 until the marker oscillator pip coincides with the minus 40 mc marker.

(5) Alternately adjust the plus and minus limits, steps (1) through (4) until the calibration is correct.

1. Disconnect the test setup and reconnect the cable to J701.

4-30. VARIABLE BANDWIDTH I-F CONTROL AMPLIFIER. To check and align the variable bandwidth i-f control amplifier proceed as follows:

a. Connect the Model 65B to J205 of the narrow band i-f amplifier.

b. Set the Model 65B to exactly 6 mc at 1000 cps, 30 percent modulation. Check this frequency with the Model 524 counter.

c. Adjust L213 for maximum deflection.

d. Disconnect the cable connecting the PREAMP OUTPUT and IF INPUT connectors on the front panel

e. Connect the Model 80 to the IF INPUT connector as shown in figure 4-15.

f. Set the Model 80 to 160 mc.

g. Set C802 and C803 (figure 4-5) to half maximum, as shown by the solder blob locations in figure 4-15.

h. Set L803, T803 and T802 for minimum inductance.

i. Set the BANDWIDTH control to maximum cw position.

j. Set the DISPERSION control to maximum cw position.

k. Adjust the SWEEP SPEED control for a sweep rate of 10 cps.

l. Set the VERT GAIN control to 50 percent of maximum cw position.

m. Increase the input signal from Model 80 until it is visible on the crt display.

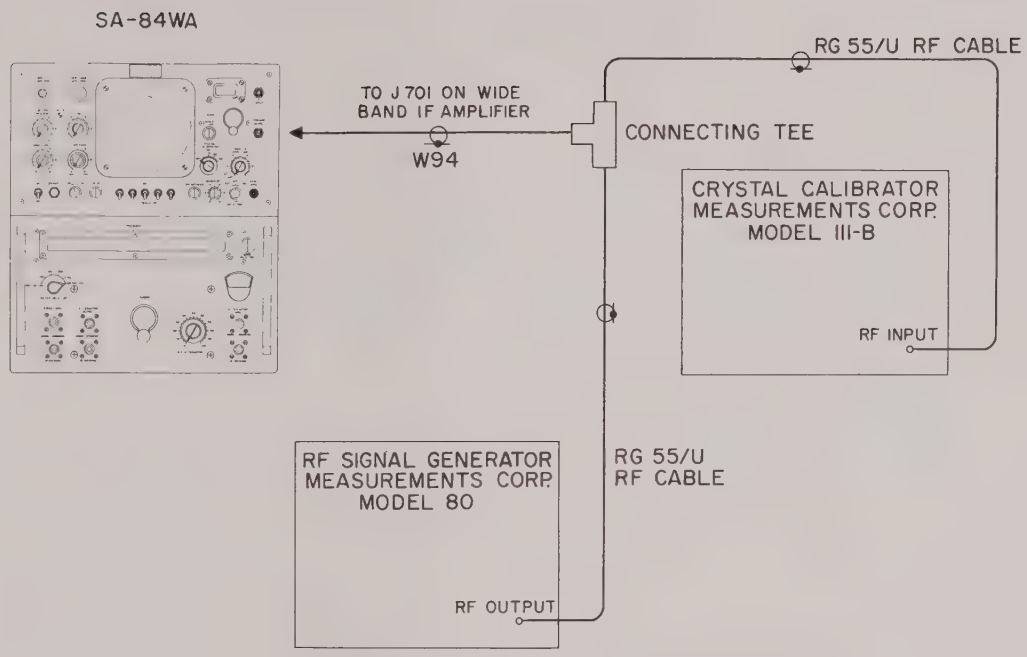


Figure 4-14. Test Setup for Checking and Aligning the Marker Oscillator

n. Adjust L803 for maximum deflection on the crt display.

o. Adjust the VERT GAIN control to obtain "one box" of signal.

p. Adjust DISPERSION control for 300 kc dispersion.

q. Adjust T801 and T802 alternately for minimum deflection of the crt display.

r. Adjust the r-f input signal, and, if necessary, VERT GAIN control to obtain "3 boxes" of signal.

s. Adjust C802 and C803 for minimum amplitude of the irregularities and notch as shown in B, figure 4-16.

t. Adjust L803 for maximum output with symmetrical response as shown in C, figure 4-16.

u. Set BANDWIDTH control to maximum ccw.

v. Adjust L213 in the narrow band i-f amplifier for maximum deflection on the crt.

w. Reset C802, C803, T801, and T802, if necessary, to obtain the display shown in D, figure 4-16 with BANDWIDTH control to maximum cw. Disconnect the test setup and reconnect the cable on the front panel from PREAMP OUTPUT connector to IF INPUT connector.

4-31. VIDEO AMPLIFIER. To check the video chassis, perform the following measurements and, if needed, the following adjustments: (See figure 4-7)

a. Measure with a VTVM from terminal 2 of R508 to ground. If zero volts d-c is not indicated, adjust R508.

b. Connect the audio oscillator to J502 and place the LOG-FILTER-LIN switch in LIN position. Set the oscillator frequency for 1000 cps and the output for 4.5 volts peak-to-peak. Adjust R512 to obtain a peak-to-peak deflection of 10 cm on the crt.

c. Turn the VERT GAIN control fully counterclockwise and place the LOG-FILTER-LIN switch to LIN. Observe the base line on the crt.

d. Place the LOG-FILTER-LIN switch to LOG. The base line should remain in the same position observed in step b.

e. If this indication is not obtained, adjust R555 to return the base line to the same position observed in step b.

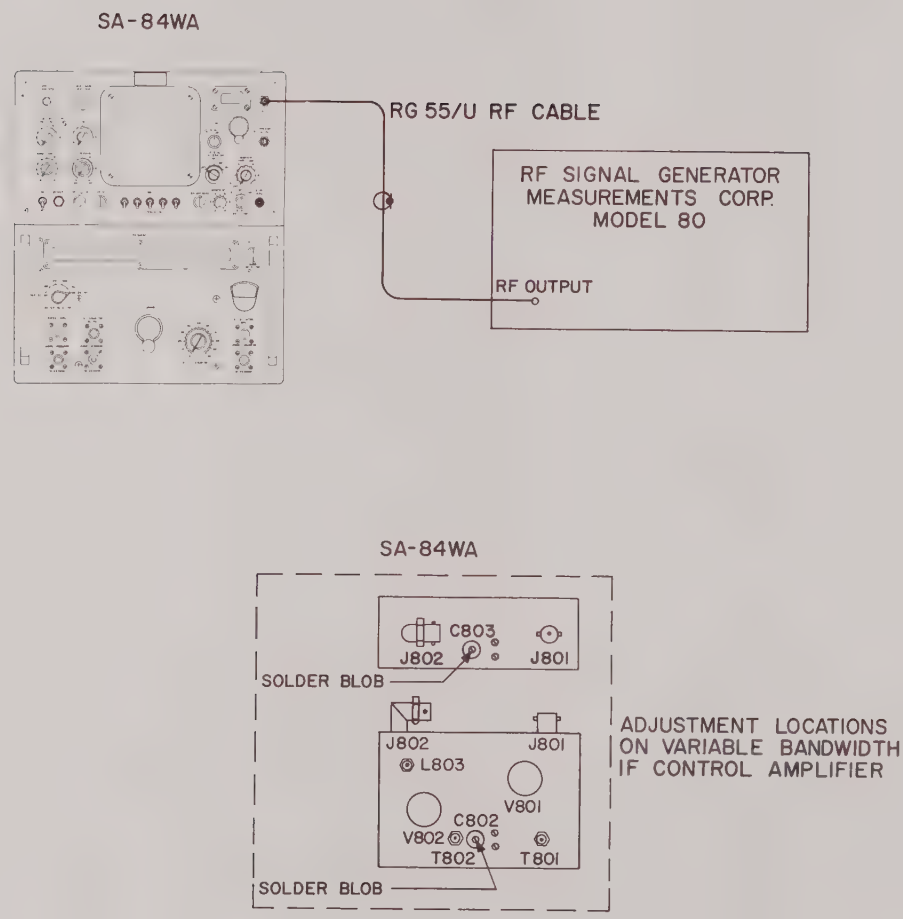


Figure 4-15. Test Setup for Checking and Aligning the Variable Bandwidth I-F Control Amplifier

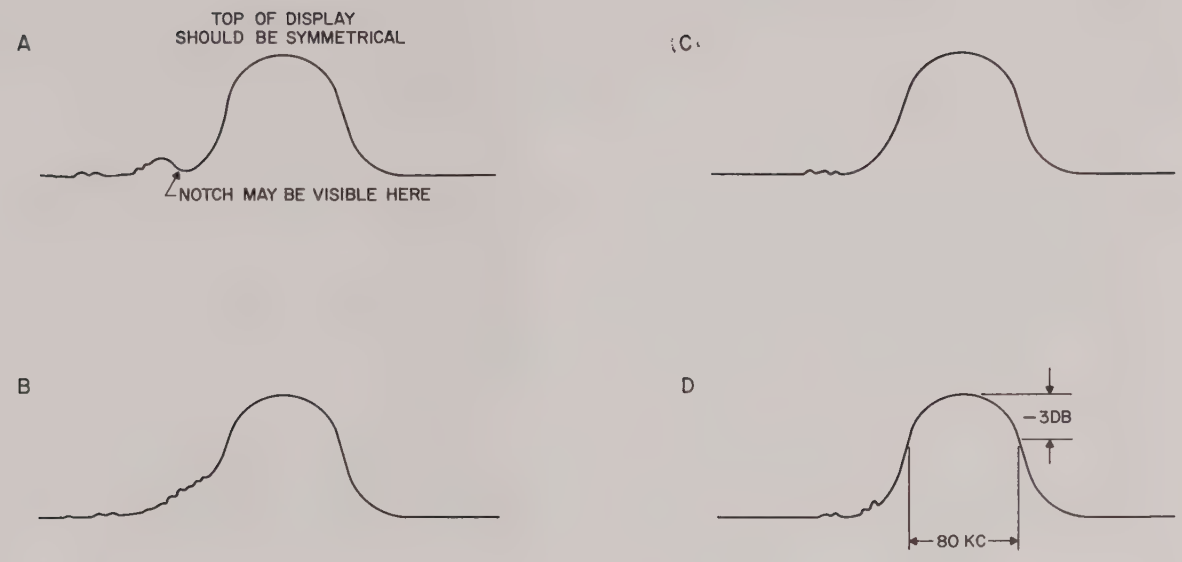


Figure 4-16. Response Curves for Aligning the Variable Bandwidth I-F Control Amplifier

f. Set the controls of the spectrum analyzer for an 80 mc dispersion and observe the crt for retrace and signal foldover. If needed, adjust R515 (figure 4-7) so that no retrace of signal foldover appears on the screen. Do not overblank.

g. With the DISPERSION HIGH-LOW switch in HIGH position and the DISPERSION control maximum clockwise, check the dispersion with the marker oscillator. If it is not 80 mc, adjust R536 for 80 mc dispersion.

h. With the DISPERSION HIGH-LOW switch in LOW position and the DISPERSION control maximum clockwise, check the dispersion with the marker oscillator. If it is not 10 mc, adjust R537 for 10 mc dispersion.

i. With the spectrum analyzer set for 80 mc dispersion, and the FREQUENCY DIFFERENCE MCS dial set at zero, check to determine if the full range of the CENTER FREQUENCY control moves the marker to each side of the screen. If this indication is not obtained, adjust R585 and R587.

j. Inject a 500 kc signal from the Model 65B Signal Generator into J502 and adjust C512 for minimum deflection on the screen of the cathode-ray tube.

4-32. R-F TUNING UNIT. If the klystron oscillator V101 fails to perform satisfactorily, it may require replacement. Before attempting to replace the tube, make certain that operating power is turned off. Remove the r-f tuning unit from the main chassis and replace the klystron as outlined in paragraphs 4-16 through 4-19.

a. If the replacement klystron is a 6BL6, turn Anode Current potentiometer R101 maximum counterclockwise and proceed with the reflector tracking adjustments.

b. If the klystron is a 5836 or ZV1009, connect the Model 260 multimeter from R101 pin 1 (negative) to R101 pin 2 (positive) and adjust R101 for an indication of 10 volts.

4-33. Repeller Voltage Tracking Adjustments. (See figures 4-17 through 4-20.) The repeller voltage tracking procedure which follows is based on the assumption that the spectrum analyzer was previously aligned and operating satisfactorily, or that the klystron tube was changed after alignment. Before making any adjustments, check for some crystal current over the entire band. The tracking adjustment of the previous tube may be satisfactory for the replacement tube if there is crystal current across the band. To set the repeller tracking voltages, if required, use the test set-up shown in figure 4-17. Proceed as indicated in the following steps:

a. Check the power supply reflector voltage at test socket J603. The power supply should measure minus 733 volts with respect to ground. If this indication is not obtained see paragraph 4-23.

b. The Klystron Mode Alignment Modulator, Model MK-1 is not supplied with this equipment. It can be fabricated from the schematic diagram shown in figure 4-20, or purchased from Polarad Electronics Corporation.

c. Refer to table 4-5 to set the repeller tracking voltages.

4-34. Low Frequency Local-Oscillator. If either of the low frequency local-oscillators fails to provide a satisfactory performance, oscillator tube V102 or V103 may require replacement. Since realignment may be required if either of these tubes is replaced, the technician must make certain that the oscillator tube is the source of difficulty. Refer to paragraph 4-23 for the procedure to be followed in adjustments and tests on the power supplies. The following procedure should be employed in aligning the low frequency local-oscillators:

a. Remove the defective tube and insert a replacement tube in the socket. Energize the equipment and allow a ten-minute warm-up period.

b. If V103 has been replaced, set the METER SELECTOR control to XTAL, and rotate the BAND SELECTOR to band 1.

c. Crystal current should be observed throughout band 1. The meter pointer deflection will vary as the TUNING dial is rotated; normal deflection is 1/8 to 3/4 full scale. Failure to obtain any meter reading indicates a defective tube or other electrical component within the local-oscillator circuit.

d. If crystal current is normal, set the Model HP 608C/D to 200 mc, at approximately -40 dbm output, and connect the output to DIRECT INPUT jack J102 (see figure 4-21). Set the CRYSTAL CALIBRATOR MC switch to 10. Set the TUNING control to 200 mc and zero the signal generator at the 200 mc crystal calibrator marker.

e. Energize the marker oscillator circuit by rotating the MARKER AMPLITUDE control clockwise, beyond its OFF position. Set the FREQUENCY DIFFERENCE MCS dial to 0. Zero this against the 10 mc marker which remains stationary when the main tuning control is rotated.

f. Observe the spectrum analyzer display for the appearance of two pips; one pip represents the marker output, the second represents the signal generator output. If both pips coincide within 4 mc, no further adjustments at the high frequency end of the dial are required. If the two pips do not coincide, proceed as follows:

(1) Adjust the threaded nylon rod adjacent to the tube, which varies the capacitive component C138 of the oscillator tank, while observing the screen for the coincidence of the two pips. Place the dust cover over the oscillator assembly and observe the displacement of the signal generator pip on the CRT. Adjust the nylon rod to compensate for any shift in frequency due to the replacement of the dust cover.

(2) Set the TUNING control at 10 mc. Set and zero the generator signal at the 10 mc crystal calibrator marker.

(3) Observe the marker and signal generator pips. If they coincide within 2 mc no further adjustments are required. If not, adjust L102 to bring the pips within 2 mc of each other.

(4) Repeat steps d through f(3) until no further adjustments are necessary. The frequency should be within ±1% of the Local Oscillator frequency over this band.

g. If V102 has been replaced, set the METER SELECTOR switch to XTAL and rotate BAND SELECTOR to Band 2.

h. Crystal current should be observed throughout Band 2. The meter pointer deflection will vary as the TUNING dial is rotated: normal deflection is 1/8 to 3/4 full scale. Failure to obtain any meter reading indicates a defective tube or other electrical component within the local-oscillator circuit.

i. If the crystal current is normal, set the Model 612A to exactly 530 mc, checking the frequency against the Model 111B Crystal Calibrator. Set the TUNING control at 530 mc.

j. Energize the marker oscillator circuit by rotating the MARKER AMPLITUDE control clockwise, beyond its OFF position. Set the FREQUENCY DIFFERENCE MCS dial to 0. Adjust the oscillator tuning rod C137 to superimpose the 530 mc signal on the internal marker.

k. If the frequency difference between the two signals is greater than 7 mc, proceed as follows:

(1) Set the Model 612A signal generator to exactly 640 mc, checking its frequency against the Model 111B Crystal Calibrator. Set the TUNING control at 640 mc. If the frequency difference is greater than 8 mc, adjust C136 to superimpose the 640 mc signal and the internal marker.

(2) Using the Model 608 C/D signal generator, set it to exactly 240 mc, checking the frequency against the crystal calibrator. Set the TUNING control to 240 mc. If the frequency difference is greater than 4 mc, bend the tab located in the center of L141 to superimpose the 240 mc signal and the internal marker.

(3) Repeat steps i through k(2) until no further adjustments are necessary. The frequency should be within ±1% of the local-oscillator frequency over this band.

4-35. 165 MC Low Pass Filter. Alignment of the 165 mc low pass filter is required only if there are spurious signals present on Band 1 when no signal is applied, or if the amplitude response of Band 1 is incorrect.

TABLE 4-5. SETTING REPELLER TRACKING VOLTAGES

Step	Adjustment	Adjustment location	Normal Indication
1	Set ON-OFF switch to ON. Wait approximately 90 seconds for the delay relay to complete its cycle	Front panel	POWER indicator lights
2	Rotate BAND SELECTOR to Band 5	Front panel	2000-4400 mc scale is visible on the frequency drum
3	Rotate TUNING knob to set frequency dial to high end	Tuning unit front panel	4400 mc calibration mark appears under the index hairline
4	Adjust the AMP and PHASE SHIFT potentiometers	Model MK-1	A single mode pattern appears on the screen
5	Check the frequency by adjusting the wavemeter until a pip appears in center of mode pattern	Wavemeter, Model H410A	Wavemeter reads within ±1% of dial calibration. If indication is normal proceed with step 8. If indication is not normal, proceed with step 6
6	Set the wavemeter to 4560 mc. Loosen the setscrew which locks the top push-rod adjustment screw. Adjust the push rod to set the pip in the center of the mode	On oscillator push plate (see figure 4-18)	Pip appears in center of mode pattern
7	Lock push-rod adjustment screw in place, by tightening the setscrew	On oscillator push plate	The pip remains centered on the mode pattern
8	Adjust HIGH LIMIT control R102	R-f tuning unit (see figure 4-19)	The mode moves to the center of the screen
9	Rotate TUNING knob to set frequency dial to low end	Tuning Unit front panel	2000 mc calibrations mark appears under the index hairline
10	Adjust the AMP and PHASE SHIFT control	Model MK-1	A single mode pattern appears on the screen (see figure 4-20)
11	Repeat steps 5 through 7 except set wavemeter Model N410A to 2,160 mc		
12	Adjust LOW LIMIT control R104	R-f tuning unit (see figure 4-19)	The mode moves to the center of the screen
13	Repeat steps 3 through 12 until no further adjustment is required		The modes remain centered without further adjustment, as the steps are repeated

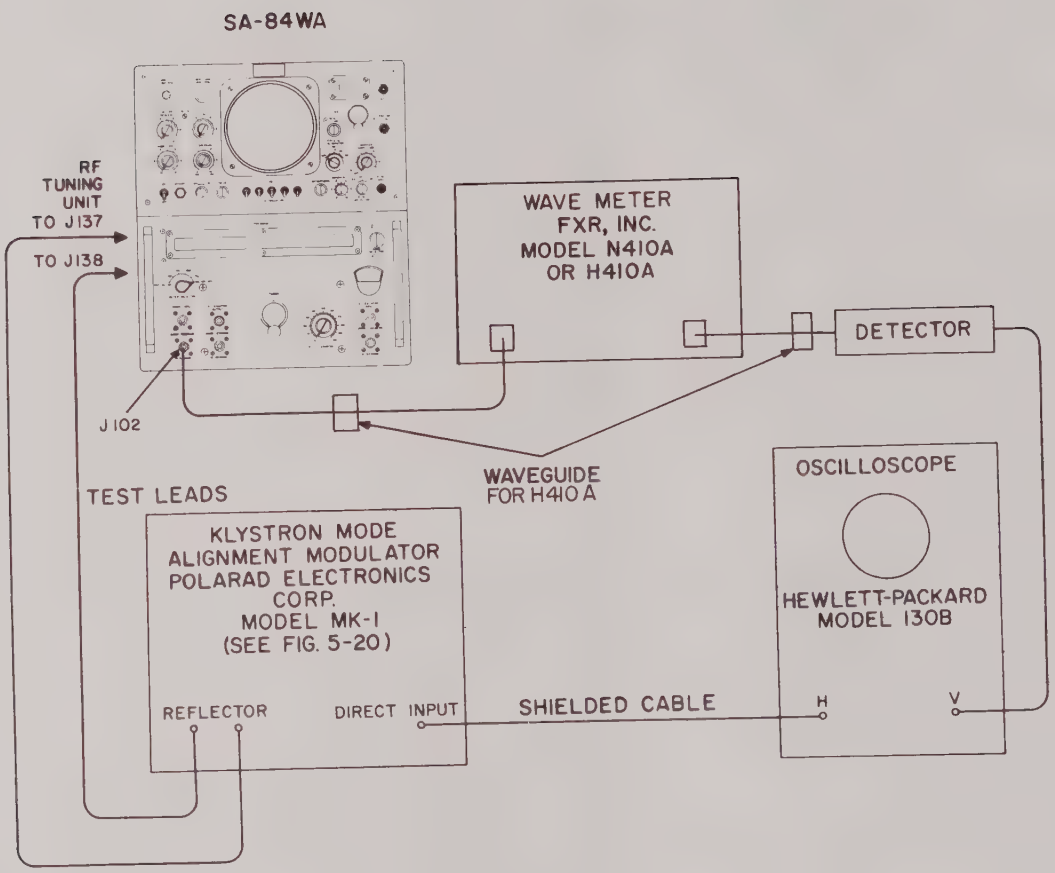


Figure 4-17. Test Setup for Checking and Aligning the R-F Tuning Unit

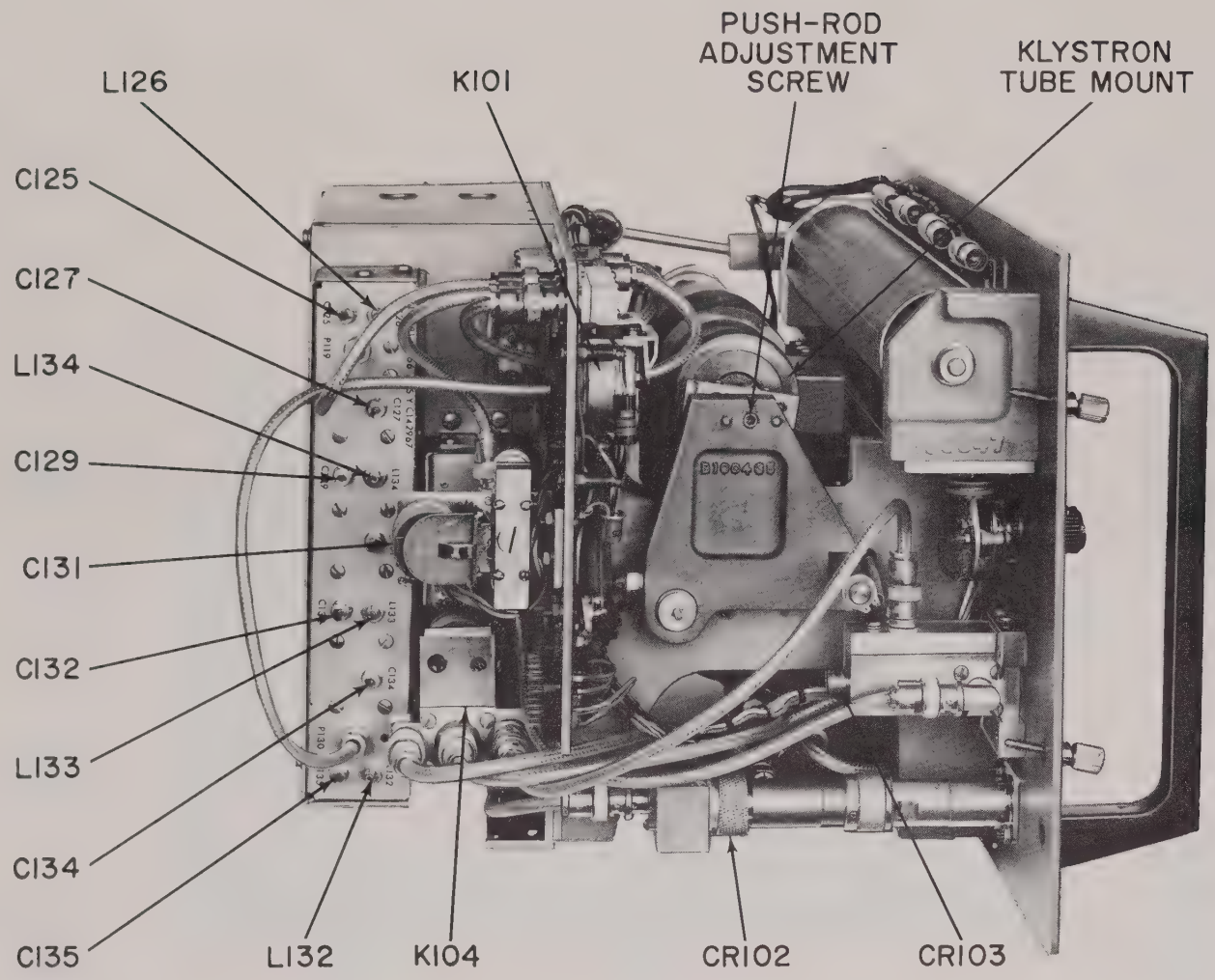


Figure 4-18. Left Side View of R-F Tuning Unit

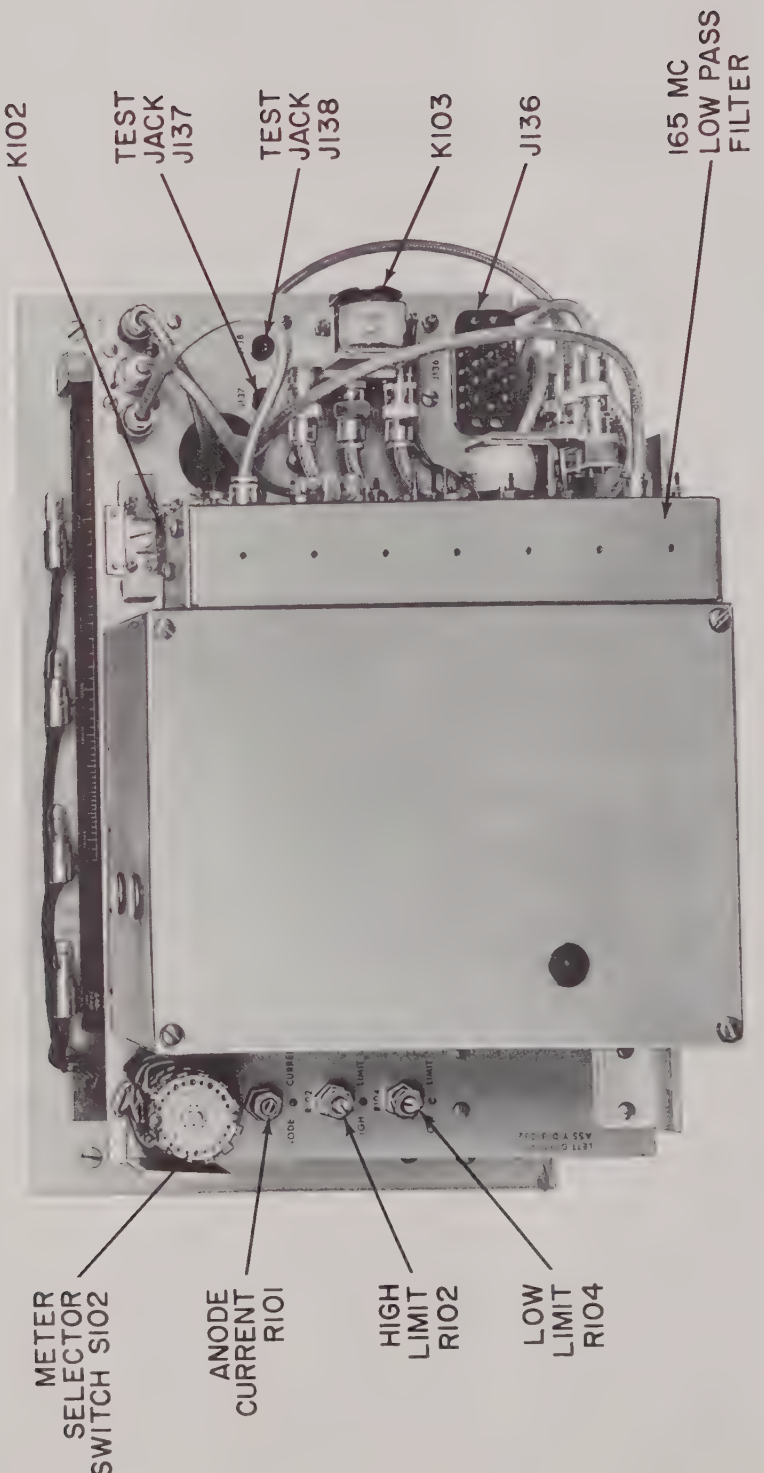


Figure 4-19. Rear View of R-F Tuning Unit

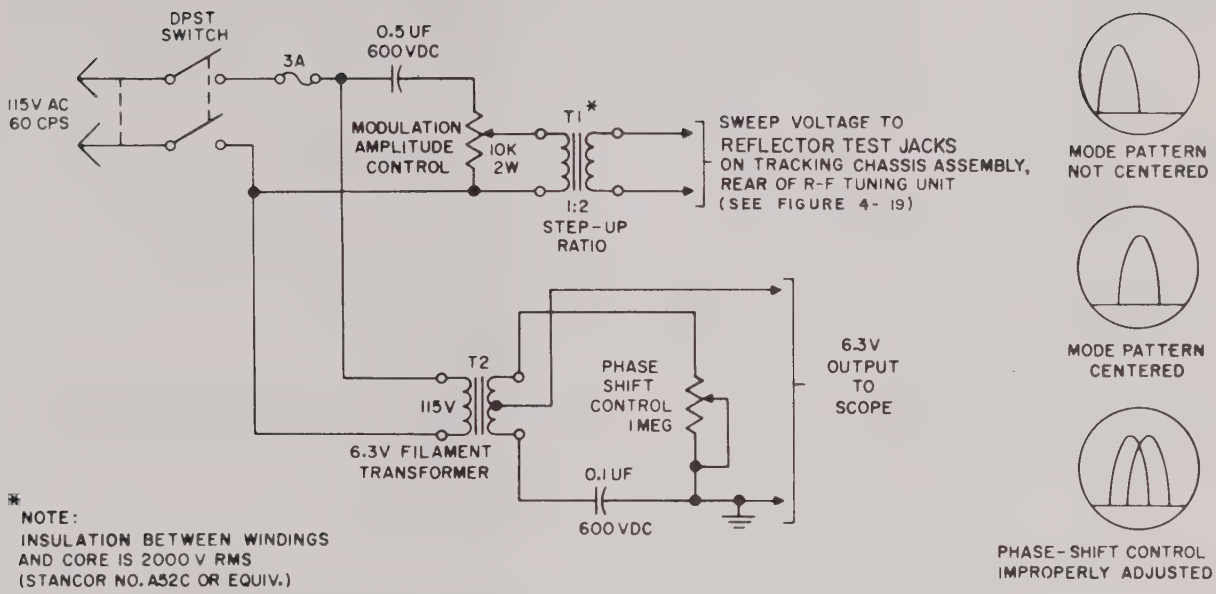

DPST SWITCH
0.5 UF 600 VDC
3A
115 V AC 60 CPS
MODULATION AMPLITUDE CONTROL
10K 2W
T1 *
SWEEP VOLTAGE TO REFLECTOR TEST JACKS ON TRACKING CHASSIS ASSEMBLY, REAR OF R-F TUNING UNIT (SEE FIGURE 4-19)
1:2 STEP-UP RATIO
T2
115 V
6.3 V FILAMENT TRANSFORMER
PHASE SHIFT CONTROL 1 MEG
0.1 UF
600 VDC
6.3 V OUTPUT TO SCOPE
* NOTE: INSULATION BETWEEN WINDINGS AND CORE IS 2000 V RMS (STANCOR NO. A52C OR EQUIV.)
MODE PATTERN NOT CENTERED
MODE PATTERN CENTERED
PHASE-SHIFT CONTROL IMPROPERLY ADJUSTED

Figure 4-20. Modulator and Phase Shifting Circuits, Schematic Diagram

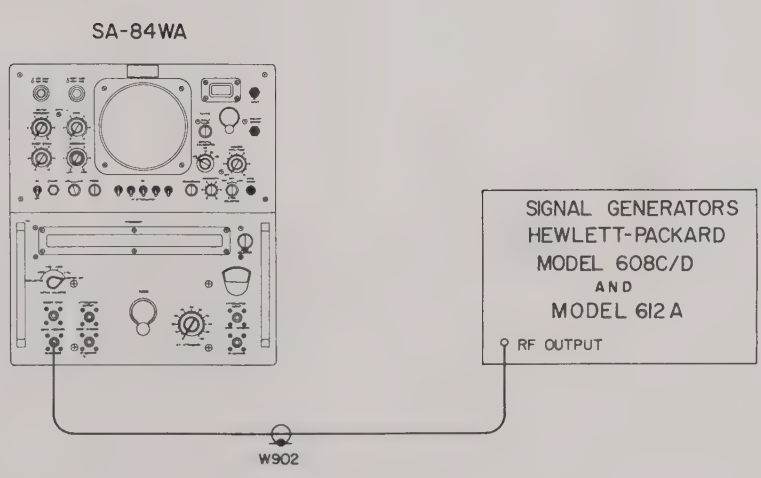


Figure 4-21. Test Setup for Checking and Aligning the R-F Tuning Unit Low Frequency Oscillator

a. Remove the filter from its dust cover and connect it to the test equipment as shown in figure 4-22.

b. Set the Model 608 C/D signal generator to 188 mc.

c. With a jumper wire, short all sections of the filter except L132 and C135. Insert a brass slug in L126.

d. Adjust C135 for minimum signal display on the cathode-ray tube. Remove the jumper.

e. Short all sections of the filter with the jumper wire except L126 and C125. Remove the brass slug from L126 and place it in L132.

f. Adjust C125 for minimum signal display on the cathode-ray tube. Remove the jumper.

g. Set the Model 608 C/D signal generator to 178 mc.

h. Connect the jumper wire from C131 to L126.

i. Remove the brass slug from L132 and place it in L134.

j. Adjust C132 for minimum signal display on the cathode-ray tube. Remove the jumper.

k. Set the Model 608 C/D signal generator to 171 mc.

l. Connect the jumper wire from C131 to L132.

m. Remove the brass slug from L134 and place it in L133.

n. Adjust C129 for minimum signal display on the cathode-ray tube.

o. Remove the jumper wire and the brass slug and set up the equipment as shown in figure 4-23.

p. Adjust C134, C131, C127 and all the series inductances to obtain the lowest insertion loss and smallest amplitude variations over the frequency range from 155 through 165 mc.

4-36. Preamplifier. To check the gain and frequency response of the preamplifier, set up the equipment as shown in figure 4-25 and adjust T851 and C855 to obtain the response curve illustrated in figure 4-26. The amplitude variation in the range from 120 mc to 200 mc should be less than 1db and the gain should be a minimum of 6db.

4-37. IF ATTENUATOR. To check the performance of each attenuation step, proceed as follows:

a. Connect the test equipment as shown in figure 4-24.

b. Set the r-f signal generator to 64 mc, 30% modulated at 1000 cps.

c. Refer to figure 5-2 for the proper value of attenuation of each step. If attenuation of one step is off, a resistor in that step has changed value and must be replaced.

d. Disconnect the test setup and reconnect the i-f attenuator.

4-38. REPLACEMENT OF CRYSTAL MIXERS.

4-39. The crystal mixers CR102 and CR103 may be replaced by referring to figure 4-18 and proceeding as follows:

a. To replace CR102, unscrew the knurled nut on the rear of the mixer assembly. The end of the crystal is now accessible.

b. To replace CR103, unscrew the large threaded cover on the rear of the mixer assembly. The crystal is now accessible.

4-40. LUBRICATION. Oilite bearings are used on those parts of the equipment which have moving parts. These bearings require no lubrication during the life of the equipment. Under severe salt-air conditions, a small amount of light liquid petrolatum may be applied to the contacts of the two wafer switches, METER SELECTOR and BAND SELECTOR, after first cleaning with trichlorethylene.

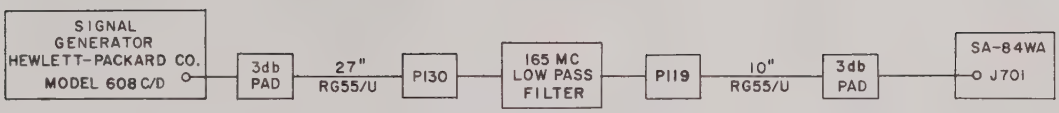


Figure 4-22. Test Setup for Checking and Aligning the 165 mc Low Pass Filter — Stop Band Response

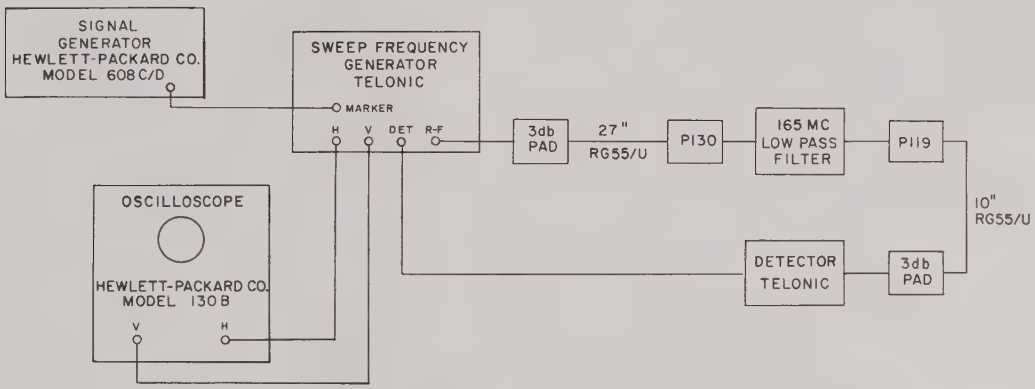


Figure 4-23. Test Setup for Checking and Aligning the 165 mc Low Pass Filter — Pass Band Response

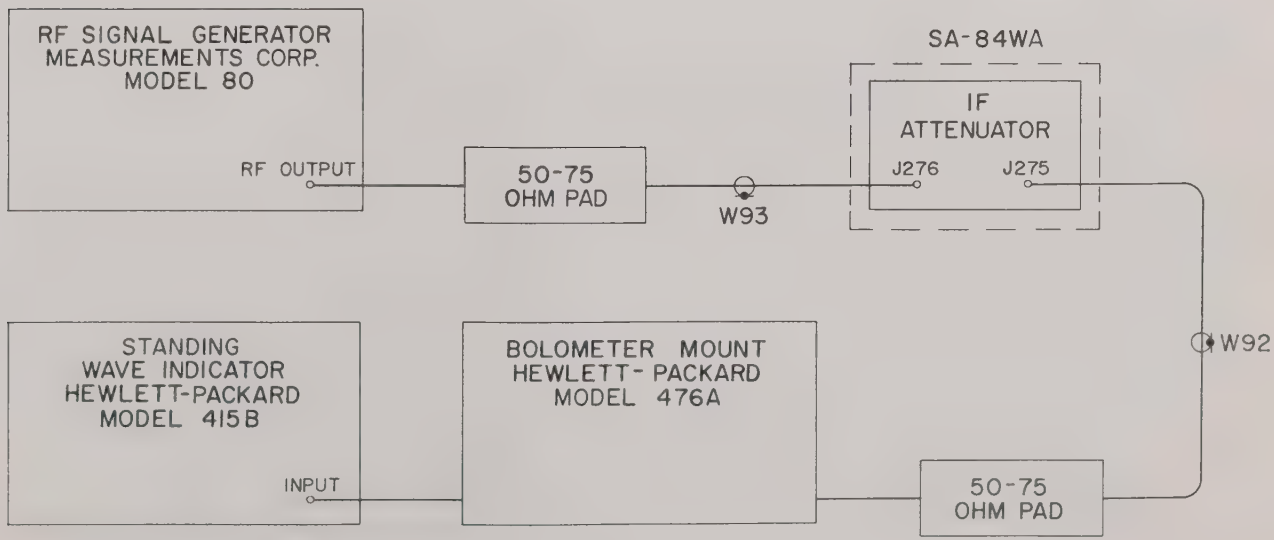


Figure 4-24. Test Setup for Checking and Calibrating the I-F Attenuator

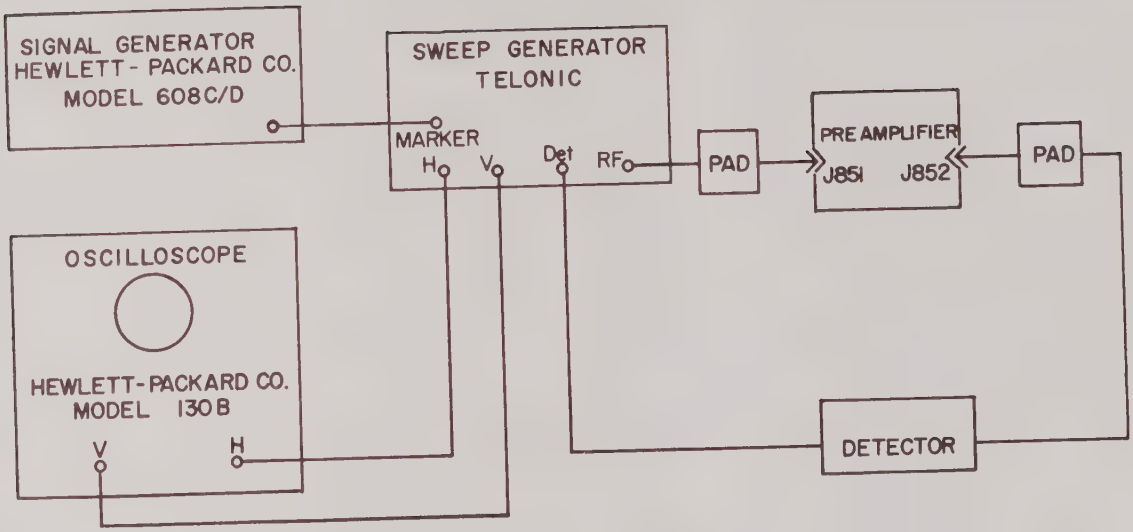


Figure 4-25. Test Setup for Checking and Aligning the Preamplifier

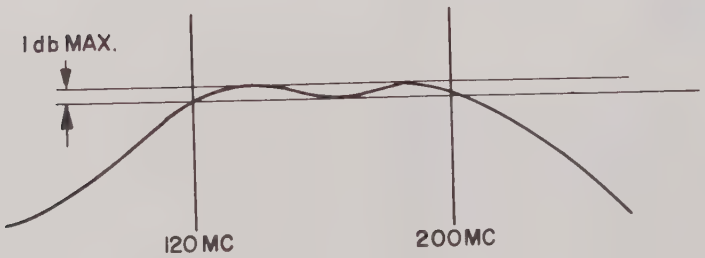


Figure 4-26. Response Curve Showing Gain and Frequency Response of the Preamplifier

SECTION V

DIAGRAMS

5-1. SCOPE OF SECTION.

5-2. Section V contains the diagrams for Model SA-84WA. The schematic diagrams, figures 5-1 through 5-4, are referred to in Section III and should also be used to supplement the maintenance instructions of Section IV. The cabling diagram, figure 5-5, is also supplied to supplement the maintenance instructions. The voltage and resistance measurements, tables 5-1 through 5-10, supplement the troubleshooting procedures of Table 4-4.

5-4. CONTROL SETTINGS FOR VOLTAGE AND RESISTANCE MEASUREMENTS. The voltage and resistance measurements listed in tables 5-1 through 5-10 were made with the front panel controls in the positions listed below:

IF ATTENUATOR switches - All switches set in OFF position.

LOG-FILTER-LIN switch - Set to LIN.

DISPERSION switch - Set to LOW.

DISPERSION control - Rotated fully clockwise.

BANDWIDTH control - Rotated fully clockwise.

SWEEP SPEED control - Rotated fully clockwise.

SYNC SELECTOR switch - Set to LINE.

SYNC control - Set between 2 and 3.

MARKER AMPLITUDE control - Rotated fully clockwise.

HOR. GAIN and HOR. POS. controls - Adjusted for a 10 cm wide trace.

VERT GAIN and VERT POS controls - Adjusted for a 10 cm high trace.

FREQUENCY DIFFERENCE - MCS TUNING control - Set to 0.

CENTER FREQUENCY control - Adjusted for marker pip centered on screen.

CRYSTAL CALIBRATOR switch - Set for 1, 10, 50, or 100, depending on stage of crystal calibrator being measured.

TABLE 5-1. R-F TUNING UNIT

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers 1	2	3	4	5	6	7	8	9	
XV102	6AF4A	93	-3.8	Fil			-3.8	93			Volts
Note 5		16K	8.2K				8.2K	16K			Ohms
XV103	6AF4A	80	-5.2				-5.2	80			Volts
Note 4		16K	8.2K				8.2K	16K			Ohms

Note:
1. FIL. = 6.3 V AC between pins so marked.
2. Voltage readings taken with a 20,000 ohm-per-volt VOM between pin and ground.
3. Resistance readings taken with power cable removed.
4. Band 1 operation.
5. Band 2 operation.

TABLE 5-2. KLYSTRON AND LOW-VOLTAGE POWER SUPPLY

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers 1	2	3	4	5	6	7	8	9	
XV601	5R4		330		-700		-700		330		Volts
			∞		50K		50K		∞		Ohms
XV602	6AR6	1.9		330		330	Fil	-50	Fil		Volts
		100		∞		∞	0	1.2M	0		Ohms
XV603	12AX7	-22	-60	-60	Fil	Fil	-60	-150	-150	Fil	Volts
		1.2M	68K	30K	0	0	68K	500K	32K	0	Ohms
XV604	0A2				-150	0					Volts
					32K	0					Ohms
XV605	0A2				-475	-325					Volts
					∞	30K					Ohms
XV606	0A2				-625	-475					Volts
					∞	∞					Ohms
XV607	0B2				-733	-625					Volts
					50K	∞					Ohms
XV608	6080	60	260	125	60	260	125	Fil	Fil		Volts
		470K	470K	15K	470K	470K	15K	0	0		Ohms
XV609	6080	210	470	300	210	470	300	Fil	Fil		Volts
		450K	1M	23K	450K	1M	23K	0	0		Ohms
XV611	6080	60	260	125	60	260	125	Fil	Fil		Volts
		470K	470K	15K	470K	470K	15K	0	0		Ohms
XV612	12AX7	60	-.6	0	Fil	Fil	-.6	-50	-50	Fil	Volts
		470K	500K	0	0	0	500K	60K	42K	0	Ohms
XV613	5881		Fil	80	125	-5.2		Fil	0		Volts
			0	500K	15K	500K		0	0		Ohms
XV614	12AX7	210	160	160	Fil	Fil	160	0	0	Fil	Volts
		450K	500K	28K	0	0	500K	0	80K	0	Ohms
XV615	5651		-87			0					Volts
			45K			0					Ohms
XV620	12AX7	-5.2	-87	-85	Fil	Fil	0	-85	-85	Fil	Volts
		500K	45K	72K	0	0	0	87K	72K	0	Ohms

Note: 1. FIL. = 6.3 V AC between pins so marked.
2. Voltage readings taken with a 20,000 ohm-per-volt VOM between pin and ground.
3. Resistance readings taken with power cable removed.

TABLE 5-3. CRYSTAL CALIBRATOR

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers 1	2	3	4	5	6	7	8	9	
XV351 Note 5	12AT7	125	0	1.3	0	0	125	0	1.3	Fil	Volts
		15K	4.7K	390	0	0	15K	0	390	0	Ohms
XV352 Note 5	6AK5	0	1.5	Fil	0	125	125	1.5			Volts
		10K	100	0	0	15K	15K	100			Ohms
XV353 Note 6	5763	300		0	Fil	0	270	0	-14	-14	Volts
		23K		0	0	0	35K	0	50K	50K	Ohms
XV354 Note 4	12AT7	125	-31	0	0	0	125	0	0	Fil	Volts
		15K	33K	0	0	0	15K	33K	0	0	Ohms
XV355 Note 4	12AX7	118	0	4	0	0	112	0	4	Fil	Volts
		38K	100K	6.8K	0	0	38K	100K	6.8K	0	Ohms

TABLE 5-4. WIDE-BAND IF AMPLIFIER

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers 1	2	3	4	5	6	7	8	9	
XV701	6922	95	0	1.8	Fil	0	95	0	1.8	0	Volts
		17K	0	68	0	0	17K	0	68	0	Ohms
XV702	6922	115	0	2.0	0	Fil	115	0	2.0	0	Volts
		15K	0	100	0	0	75K	0	100	0	Ohms
XV703	6922	115	0	2.0	0	Fil	115	0	2.0	0	Volts
		15K	0	100	0	0	15K	0	100	0	Ohms
XV704	6922	95	0	1.8	0	Fil	95	0	1.8	0	Volts
		16K	0	100	0	0	15K	0	100	0	Ohms

Note:
1. FIL. = 6.3 V AC between pins so marked.
2. Voltage readings taken with a 20,000 ohm-per-volt VOM between pin and ground.
3. Resistance readings taken with power cable removed.
4. Crystal calibration selector in 1 MC position.
5. Crystal calibration selector in 50 MC position.
6. Crystal calibration selector in 100 MC position.

TABLE 5-5. NARROW-BAND IF AMPLIFIER

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers									
		1	2	3	4	5	6	7	8	9	
XV201	6AK5	0	3.5	Fil	0	125	120	3.5			Volts
		0	1.5K	0	0	15K	20K	1.5K			Ohms
XV202	6BE6	2.6	1.3	Fil	0	125	106	0			Volts
		22K	150	0	0	15K	17K	100K			Ohms
XV203	6BE6	-1.8	1.6	Fil	0	98	98	0			Volts
		22K	150	0	0	18K	18K	10K			Ohms
XV204	6AH6	0	3.5	Fil	0	120	120	3.5			Volts
		3.3K	1.5K	0	0	16K	16K	1.5K			Ohms
XV205	6AH6	0	1.5	Fil	0	115	115	1.5			Volts
		3.3K	220	0	0	16K	16K	220			Ohms

TABLE 5-6. SWEEP FREQUENCY GENERATOR

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers									
		1	2	3	4	5	6	7	8	9	
XV403	6AQ5/ 6005	-19	2.5	Fil	0	250	270	-19			Volts
		100K	100	0	0	24K	28K	100K			Ohms
XV405 Note 4	5718	-1.1		Fil		0	0		150		Volts
		27K		0		0	0		33K		Ohms
XV406 Note 4	5718	-1.1		Fil		0	0		150		Volts
		27K		0		0	0		33K		Ohms
XV408	6AK5	0	1.4	Fil	0	104	104	1.4			Volts
		0	100	0	0	16K	16K	100			Ohms
XV409 Note 5	5718	-3		0		0	Fil		150		Volts
		27K		0		0	0		35K		Ohms

TABLE 5-7. MARKER OSCILLATOR

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers									
		1	2	3	4	5	6	7	8	9	
XV301	6AF4A	110	-7	Fil	0	6.6	-7	110			Volts
		20K	10K	0	0	470	20K	20K			Ohms

Note:
1. FIL. = 6.3 V AC between pins so marked.
2. Voltage readings taken with a 20,000 ohm-per-volt VOM between pin and ground.
3. Resistance readings taken with power cable removed.
4. Dispersion switch HIGH.
5. Dispersion switch LOW.

TABLE 5-8. VARIABLE BANDWIDTH IF CONTROL AMPLIFIER

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers									
		1	2	3	4	5	6	7	8	9	
XV801	12AT7	125	0	.6	Fil	Fil	125	0	.6	0	Volts
		15K	100K	100	0	0	15K	3.5	100	0	Ohms
XV802	6AG5	0	1.8	0	Fil	125	125	1.8			Volts
		3.5	270	0	0	15K	15K	270			Ohms

TABLE 5-9. VIDEO AMPLIFIER

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers									
		1	2	3	4	5	6	7	8	9	
XV501	6AS6	-6.5	0	Fil	0	42	120	-1.0			Volts
		5M	0	0	0	500K	30K	120K			Ohms
XV502	12AT7	300	42	65	0	0				Fil	Volts
		23K	500K	120K	0	0				0	Ohms
XV503	12AU7	115	9	28	0	0	65	25	28	Fil	Volts
		65K	22K	10K	0	0	37K	700K	10K	0	Ohms
XV504	12AU7	240	5	21	0	0	235	0	11	Fil	Volts
		45K	400K	12K	0	0	40K	10K	4.7K	0	Ohms
XV505	12AU7	165	0	8	0	0	185	-1.6	8	Fil	Volts
		115K	320K	75K	0	0	115K	350K	75K	0	Ohms
XV506	6AN8				Fil	0	75	37	0	0.7	Volts
					0	0	48K	12K	30K	2K	Ohms
XV507	6AN8	300	-21	-4	Fil	0	87	125	-3	0	Volts
		23K	500K	10K	0	0	76K	15K	85K	0	Ohms
XV508	6AH6	0	2.9	Fil	0	193	125	2.9			Volts
		30K	33K	0	0	63K	15K	33K			Ohms
XV509	6AH6	0.2	2.9	Fil	0	115	125	2.9			Volts
		370K	33K	0	0	63K	15K	33K			Ohms

Note: 1. FIL. = 6.3 V AC between pins so marked.
2. Voltage readings taken with a 20,000 ohm-per-volt VOM between pin and ground.
3. Resistance readings taken with power cable removed.

TABLE 5-10. CRT POWER SUPPLY

Voltage and Resistance Measurements

Socket	Tube Type	Pin Numbers									
		1	2	3	4	5	6	7	8	9	
XV616	6AR6	3		*		145	0	*	Fil		Volts
		100		27K		53K	0	100K	0		Ohms
XV617	1Z2 *										Volts
											Ohms
XV618	1Z2 *										Volts
											Ohms

Note: 1. FIL. = 6.3 V AC between pins so marked.
2. Voltage readings taken with a 20,000 ohm-per-volt VOM between pin and ground.
3. Resistance readings taken with power cable removed.
* Do not measure.

DIRECT INPUT
10 - 8,900 MC

J102 CR102 IN415E J126 P126

DIRECT INPUT
6,300-63,680 MC

J101 CR103 IN26A P125 J125 50 J124 P 24

W110 W103 W102 W101

P122 J122 P109 J109 J111 P 2 J112 TUNING P121

J121 J123 P123 K104

P119 J119 J131 P131 P132 J132 K103

W111 W104 W105

P133 J133 J116 P116 W107 P117 J117 J118 P118 TO J701 WIDEBAND I-F AMPL

P115 J115 K101 P130 J130 K102

165-MC LOW-PASS FILTER

L125 0.071 L126 0.077 C125 1.5-12.5
L127 0.061 L126 0.077 C126 33 C127 1.5-12.5
L134 0.085 L128 0.061 C130 33 C129 1.5-12.5
L129 0.064 C131 1.5-12.5
L130 0.064 L133 0.055 C128 5 C132 1.5-12.5 C133 33

HIGH-FREQUENCY LOCAL OSCILLATOR V101 6BL6 OR 5836

J138 R107 100K J137 C101 0.1UF 600V CR104 R106 270K

R119 1.5K 1W FE105 FE106 L102 C138 LOW-FREQUENCY LOCAL OSCILLATOR V103 6AF4A C104 1000 R120 8.2K L104 C105 1000 FE107 FE108

FE101 FE102 R115 1.5K 1W LOW-FREQUENCY LOCAL OSCILLATOR V102 6AF4A C137 L141 R114 8.2K C136 1.5-7 FE104 FE103

J128 P128 W94 TO J352 XTAL CAL R117 390 J127 P127 R118 39 L101

FL851

P/O J136 MATES WITH P/O P136 (ON DISPLAY UNIT FRAME)

C 6.3V DC RET
D 6.3V DC
P -733 V
N 6.3V AC RET
J GRD
A +300V
B +125V
H 6.3V AC
F 6.3V AC

ANODE CURRENT R101 10K R105 120K 2W R133 120K 2W R108 147 MEG 1%,2W R109 22K HIGH LIMIT R102 50K R103 100K 12W LOW LIMIT R104 50K

DS104 47 DS103 47 DS102 47 DS101 47 CR101 IN69 R111 600K,1% R112 250K,1% R113 5.1K,5% S101A S101B

1. REFL
2. LINE
3. +125
4. +300
5. XTAL
6. OFF

METER SELECTOR M101

R122 1.8K R123 100

S102E S102A S102D S102C S102B

BAND SELECTOR

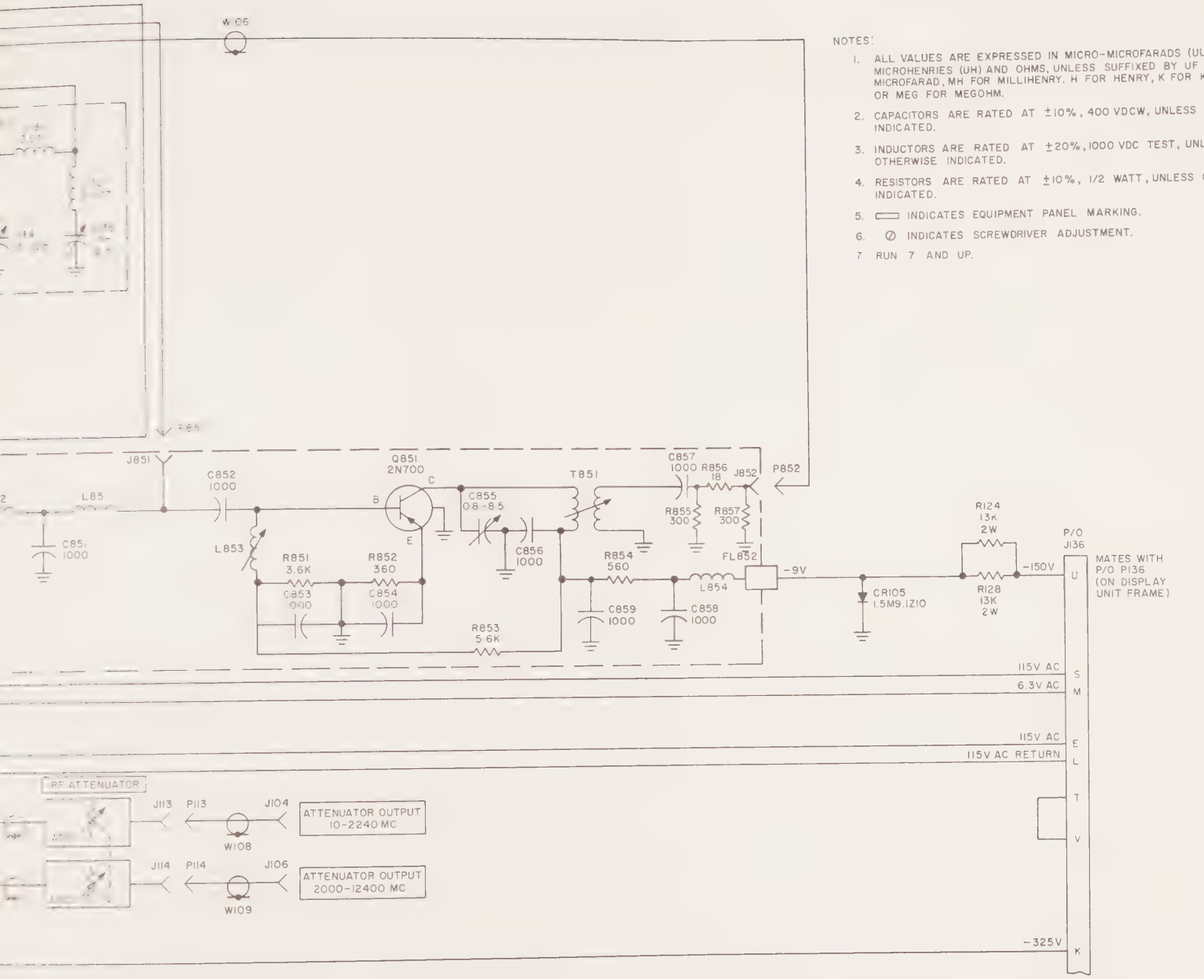
FL102 FL101 FL103

SA-84 WAF ONLY

CR106 R131 TO S102 C-1 CR108 R132 TO S102C-7,8,9,10 K103 K102 CR105 K101 CR107 TO J136-S

ATTENUATOR INPUT 10-2240 MC

ATTENUATOR INPUT 2000-12400 MC



NOTES:

1. ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF). MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.
2. CAPACITORS ARE RATED AT ±10%, 400 VDCW, UNLESS OTHERWISE INDICATED.
3. INDUCTORS ARE RATED AT ±20%, 1000 VDC TEST, UNLESS OTHERWISE INDICATED.
4. RESISTORS ARE RATED AT ±10%, 1/2 WATT, UNLESS OTHERWISE INDICATED.
5. ▭ INDICATES EQUIPMENT PANEL MARKING.
6. Ø INDICATES SCREWDRIVER ADJUSTMENT.
7. RUN 7 AND UP.

Figure 5-1. R-F Tuning Unit, Model SA-84WA, Schematic Diagram

D W46702

P111 (MATES WITH J111 ON TUNING UNIT)

W96

CRYSTAL FILTER FL501

W95

P353 J353

C366 1000, L359, C364 1000, R359 12K 1W, T351, R360 10, R361 10, C370 1000, C365 1.5-12, C360 47, C362 1000, R356 33K, C36- 000, R357 220K, R358 22K

AMPLIFIER V353 5763

L358, C355 1000, L353, C356 10, C357 5, R355 100, C358 1000, C359 1000, R354 10K

FREQUENCY DOUBLER V352 6AK5

L357, L352, L351, C353 1000, C354 100, R353 4.7K, R352 390, C35- 50MC, R351 390

50-MC OSCILLATOR V351 12AT7

L356, R368 22K 1W, R366 100K, R365 6.8K

AMPLIFIER V355 12AX7

L363, C375 1000, C388 22, L354, C378 10, C379 82, C380 82, L355, L362 5MH, C389 1000, C381 100, R364 100K, R362 33K, C376 1-12, Y352 10MC, R363 33K

10-MC OSCILLATOR V354A 1/2 12AT7

FREQUENCY DIVIDER V354B 1/2 12AT7

C351 1000 — F
C371 1000 — B — -150V
C352 1000 — D
C372 1000 — H — +125V
C374 1000 — K
C373 1000 — J
C383 1000 — A — 6.3VAC
FIL. RETURN — C
GROUND — E

→ TO P606-L
→ TO P606-BB
→ TO P606-AA

P351 J351 (ON DISPLAY UNIT FRAME)

FE355

V351 FE351 C390 1000
V352 FE352 C384 1000
V353 FE353 C385 1000
V354 FE354 C386 1000
V355 C387 1000

P152 (MATES WITH J152 ON TUNING UNIT)

W94

P352 J352

C382 150

CRYSTAL CALIBRATOR

P302 J302

MARKER AMPLITUDE

R305 500 2W

DIFFERENCE FREQUENCY MCS TUNING

C303 1.5-12.5, C306 1-22, C304 1.5-12.5, L302, L305, L306, C302 68, L303 13, C308 1000, R303 1.2K 1W, FL301, S301, + 125V

R301 10K, R302 470, C307 51

MARKER OSCILLATOR V301 6AF4A

FL302, FE301, 6.3VAC, V301 4, C301 820, FIL. RETURN, GROUND

J301 (ON DISPLAY UNIT FRAME)

MARKER OSCILLATOR

P301

SWEEP-FREQUENCY GENERATOR

R412 1K, C405 1.0UF, C428 1.0UF, R432 82, L406, L407, C404 27, R420 470 1W, R413 27K

NARROW DISPERSION LOCAL OSCILLATOR V409 5718

CR402 N824, L401, R421 .5K, L408, C414 4.7, C436 3.3, C412 47, C405, C41 47, R418 27K, R419 27K

WIDE DISPERSION LOCAL OSCILLATOR V405 5718

WIDE DISPERSION LOCAL OSCILLATOR V406 5718

C431 000, C48 1000, R424, C417 56, L409, C415 56, C416 1000, R423 1.0, C430 1000

I-F AMPLIFIER V408 6AK5

R422 51

P402 J402

C455 0.01UF, R405 150K, FE406, R406 220K, C435 01UF

L403, R411 4.7K 2W, R402 2K 5W, R425 100 2W, C438 8UF 450V

DRIVER V403 6005

J404 P404

J403 P403

W88 J651 IF INPUT

W89 PREAMP OUT J652

IF CABLE ASSEMBLY W904

W93

P276

P703 J703

R708 390, R706 1K, C707 1000, R707 560, L70-, C708 1000, L710, C709 1000, R709 10, C705 1000, L709, C706 300, R705 68

I-F AMPLIFIER V701 6922

R7-1 150, L712, L703, C710 1000, C711 100, C712 1000, C713 1000, R715 100, L704, FE702 56 5%, C714 1000

I-F AMPLIFIER V702 6922

R7-2 00, L714, L705, C715 1000, C716 1000, R713 100, L713, R714 00, C717 1000, L706

I-F AMPLIFIER V703 6922

R716 100, C718 1000, R717 390, C719 1000, L716, R720 330, L707, C724 1000, R721 150, C723 1000, C722 1000, L715, R719 100, R718 100

I-F AMPLIFIER V704 6922

J702 P702

FE702

C728 1000, C729 000, C730 1000

P704 J704 (ON DISPLAY UNIT FRAME)

+ 125V → B → TO P606-U
CRYSTAL CURRENT → H → TO P606-K
6.3VAC → A → TO P606-Y
FILAMENT RET → C → TO P606-Z
GROUND → E

P131 (MATES WITH J131 ON TUNING UNIT)

W91

P701 J701

L7-9, C705 1000, L709, C706 300, R705 68

FE701

L708, C741 1.5-12.5, R701 270, C701 1000, C702 1000, C703 1000, C704 1000, R704 1K

V701 V702 V703 V704

L717, L718, FE703, FE704, FE705, C725 1000, C726 1000, C727 1000

WIDE-BAND I-F AMPLIFIER

9	
	Volts Ohms
	Volts Ohms
	Volts Ohms

round.

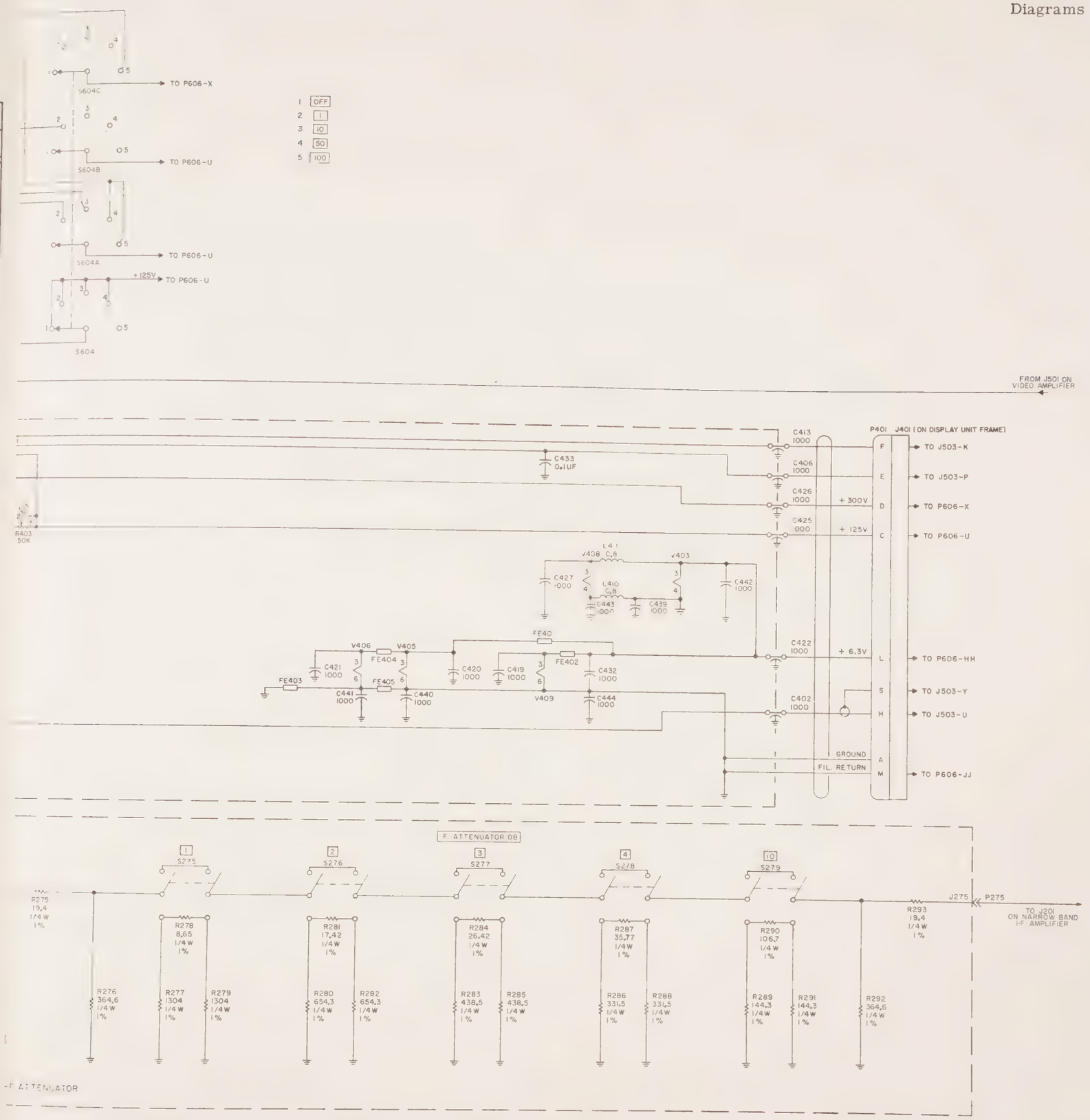


Figure 5-2. Display Unit Model SA-84WA, Schematic Diagram (Less Power Supplies and Tuning Unit) (Sheet 1)

VIDEO AMPLIFIER

PART OF P503
TO P606-X
TO P606-U
TO P606-R
LINE
OFF
EXT
J608
SYNC
SYNC SELECTOR S603
A +300V
B +125V
E
SYNC
R589 500K
R543 120K
J GROUND
M -150V
F 6.3 VAC
H FIL RETURN
TO P606-L
TO P606-J
TO P606-F
PART OF J503

C501 1000
C502 0.1UF
R503 120K
R502 470K
R501 12K
R506 100
R504 3.9MEG
C503 0.022UF
R507 33K
SWEEP SPEED
R505A 1MEG
H ZERO R508 50K
R509 56K
-150V

PHANTASTRON
V501
6AS6

CATHODE FOLLOWER
V502
12AT7
CR501 1N69
R514 270K
C504 0.02UF
R505B 25K
BLANK WIDTH R515 25K
R516 18K
C505 0.05UF
R518 47K
R519 22K
R521 680K
C506 1UF
R523 20K
R517 10K 2W
CR508 1N198
R596 470K

BLANKING MULTIVIBRATOR
V503
12AU7

R522 22K 2W
R526 68K 2W
R525 10K
R524 12K

BLANKING AND INTENSIFIER AMPLIFIER
V504
12AU7

V501 V502 V503 V504 V505 V506 V507 V508 V509

SA-84 WAT ONLY
TO J503 T
R520 820 2W
CR511
CR512
K501
TO J503 L AND S501

W85

L804 50
L805 50
C804 0.01UF
C805 0.01UF
C806 0.01UF
R802 100
R805 100
C802 3-13
C803 3-13
L803
R809 10K
C811 0.01UF
J802 P802
P801 J801
W97
C801 51
R801 100K
Y801 6MC
R804B 25K 1W
R812 33
T801
R803 100
R806 100
Y802 6MC
R804A 25K 1W
R813 33
T802
R810 100
L806 50
C807 1000
+125V
I-F AMPLIFIER
V802
6AG5
R808 270
C808 0.01UF
P803 J803 (ON

I-F AMPLIFIER
V801A
1/2 12AT7

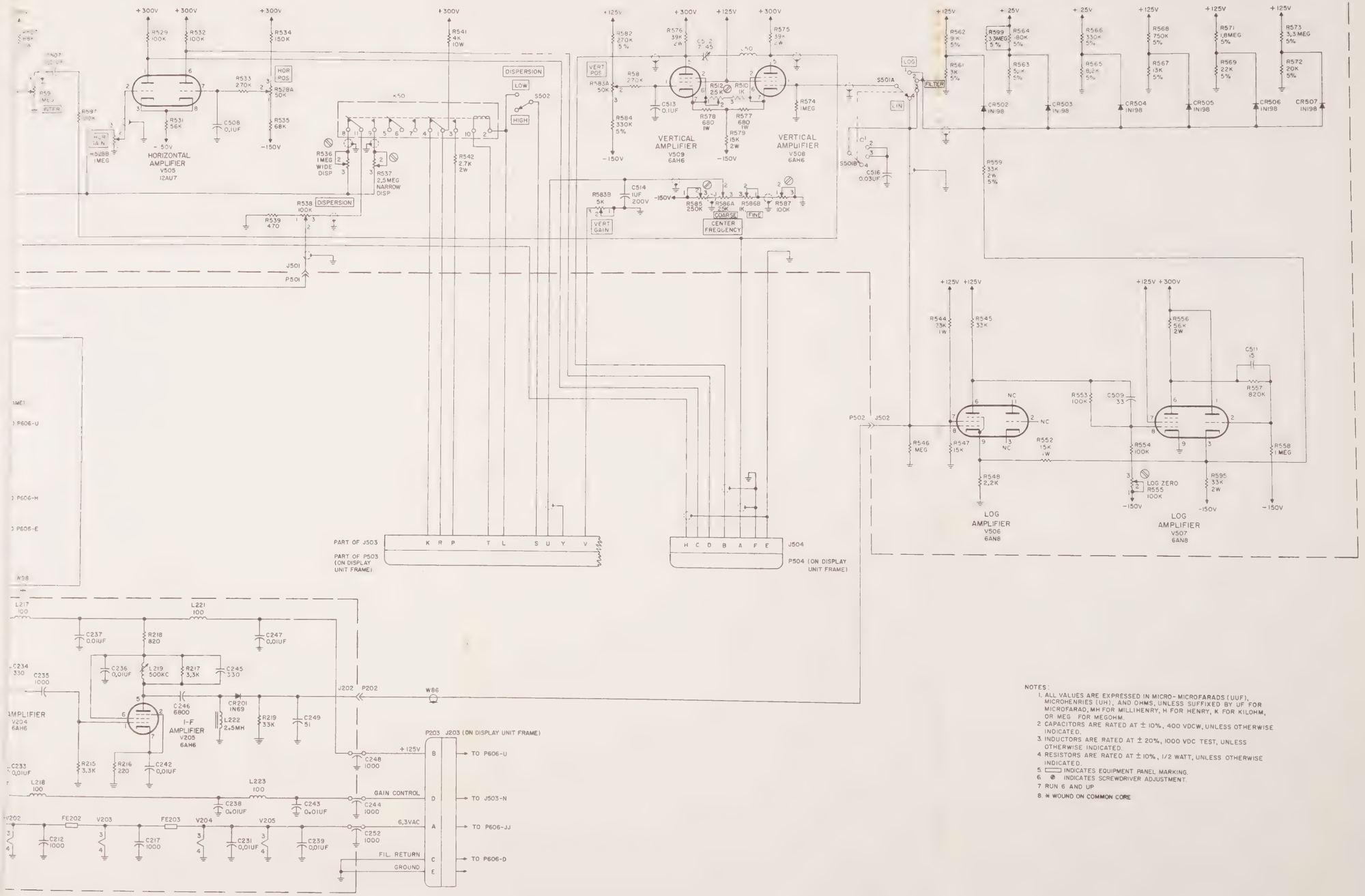
BANDWIDTH

I-F AMPLIFIER
V801B
1/2 12AT7

6.3VAC
FE801
FE802
C812 1000
C809 1000
C810 1000
FIL RETURN
GROUND
V801
V802

VARIABLE BANDWIDTH I-F CONTROL AMPLIFIER

P204 J204
P205 J205
L211 100
C204 1000
L203 5
R203 2.2K 1W
C214 0.01UF
L207 50
C218 0.01UF
R207 2.2K 1W
R208 10
C229 0.01UF
R214 820
C205 43
L202 64MC
C208 0.01UF
L205 29MC
C211 120
L225 6MC
C255 1000
C253 22
L209 500KC
C221 330
C228 0.01UF
L216 500KC
C223 1000
R201 4.7K
C209 1000
FROM J275 ON I-F ATTENUATOR
P201
W92
T201 64MC
J201
C201 56
C203 1000
C206 1000
R202 10K
R206 22K
Y201 29MC
FIRST CONVERTER
V202
6BE6
R205 150
C216 1000
C254 47
R225 100K
C219 0.01UF
SECOND CONVERTER
V203
6BE6
C224 180
C227 47
R209 150
C225 1500
L213 6.5MC
R211 22K
R212 3.3K
R213 220
C232 0.01U
I-
R204 100
L212 5
L215 5
C202 1000
C222 1000
C226 1000
I-F AMPLIFIER
V201
6AK5
V201
FE201
C207 1000
NARROW-BAND I-F AMPLIFIER



NOTES:

1. ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF), MICROHENRIES (UH), AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.
2. CAPACITORS ARE RATED AT ± 10%, 400 VDCW, UNLESS OTHERWISE INDICATED.
3. INDUCTORS ARE RATED AT ± 20%, 1000 VDC TEST, UNLESS OTHERWISE INDICATED.
4. RESISTORS ARE RATED AT ± 10%, 1/2 WATT, UNLESS OTHERWISE INDICATED.
5. ▭ INDICATES EQUIPMENT PANEL MARKING.
6. ⊕ INDICATES SCREWDRIVER ADJUSTMENT.
7. RUN 6 AND UP.
8. * WOUND ON COMMON CORE.

Figure 5-2. Display Unit Model SA-84WA, Schematic Diagram (Less Power Supplies and Tuning Unit) (Sheet 2).

H
F
S
A
P
K
B
T
V
E
N
M
C
D
R
L
J

6.3 VAC → X
6.3 VAC → X
+300 VDC
-733 VDC
-325 VDC
+125 VDC
6.3 VAC
6.3 V
XTAL CUR.

P136
(MATES WITH
J136 ON
TUNING UNIT)

R677
1
5W
R676
1
5W
C636
2000UF
15V
C637
2000UF
15V
CR613
F604
2A

T604
24
23
20
19
5
6
7
8
9
10
11
12
17
18
13
14
15
16
21
22
PIN 2 → 25
V601
PIN 8 → 26

K601
115 NO60T
TIME RELAY
K602

T601
RECTIFIER
V601, 5R4
TO T604-25
TO T604-26
C601
4UF
1500V

SERIES REG
V602
6AR6

R675
100
R601
150K
CONTROL
V603
12AX7
R603
33K
2W
R604
33K
2W

M
K
AA
BB
CC
DD
Y
Z
J
F
LL
KK
HH
JJ
E
H
T
S
N

PART OF J606
(MATES WITH P606
ON DISPLAY UNIT
FRAME)

CR615
IN2970A
R678
68
2W
R679
68
2W
Q601
2N277
C632
2000
UF
C633
2000
UF
F603
4 AMP
SB
CR614
IN1341
C607B
40 UF
450 V

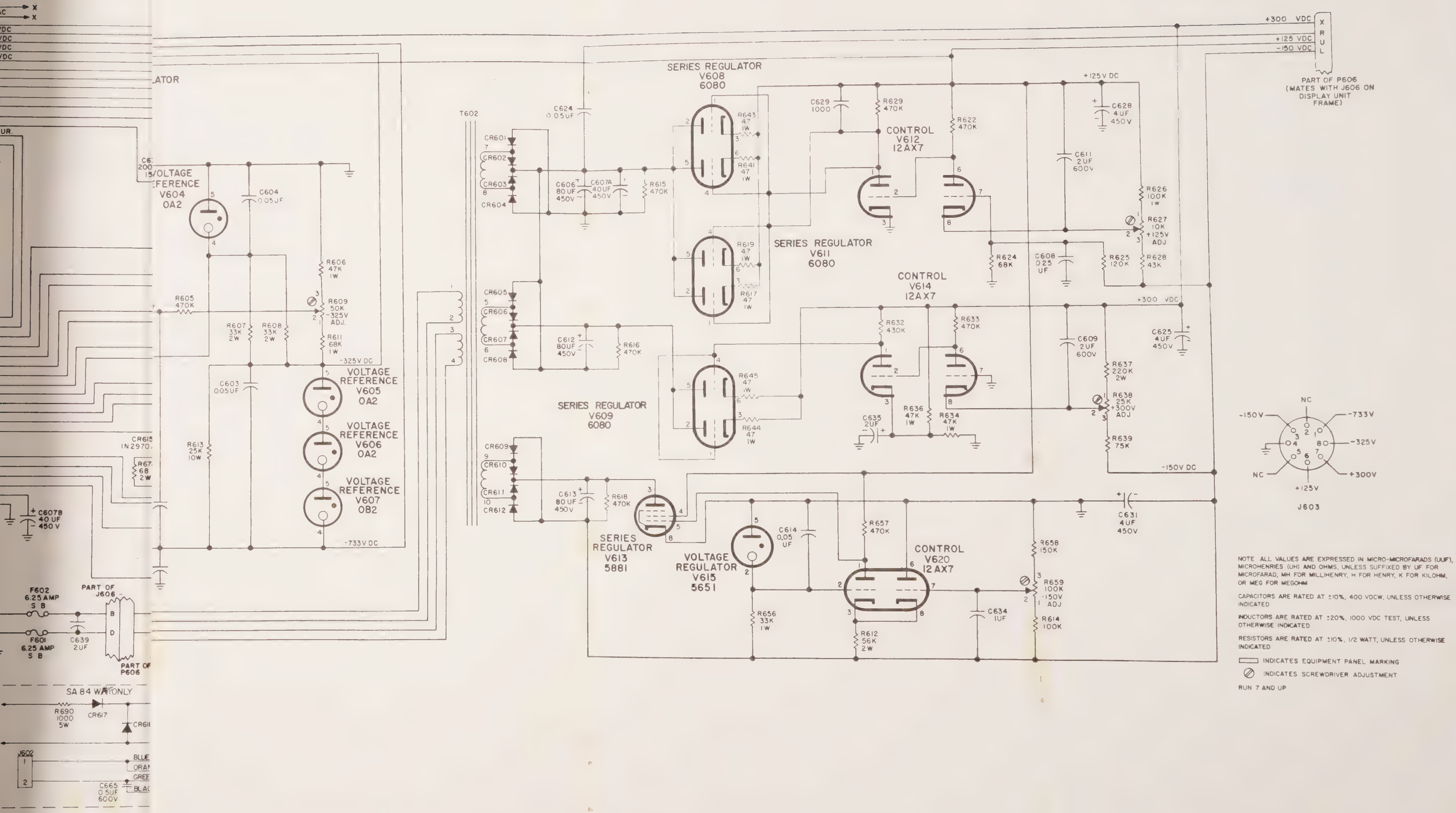
1
2
3
4
115V
1C
2C
3C
4C
230V
C1
C2
C3
C4
S602

P602
J602
BLOWER
FAN
B601

J601
AC LINE INPUT
F602
6.25 AMP
S B
F601
6.25 AMP
S B
C639
2UF
PART OF
J606
PART OF
P606
S601
OFF
ON
PART OF
J606
PART OF
P606

V602
V603
V608
V609
V611
V612
V613
V614
V616
X
X

SA 84 WA ONLY
R690
1000
5W
CR617
CR618
K601
J602
1
2
BLUE
ORANGE
GREEN
BLACK
B601
C665
0.5UF
600V



NOTE ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF), MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM

CAPACITORS ARE RATED AT ±10%, 400 VDCW, UNLESS OTHERWISE INDICATED

INDUCTORS ARE RATED AT ±20%, 1000 VDC TEST, UNLESS OTHERWISE INDICATED

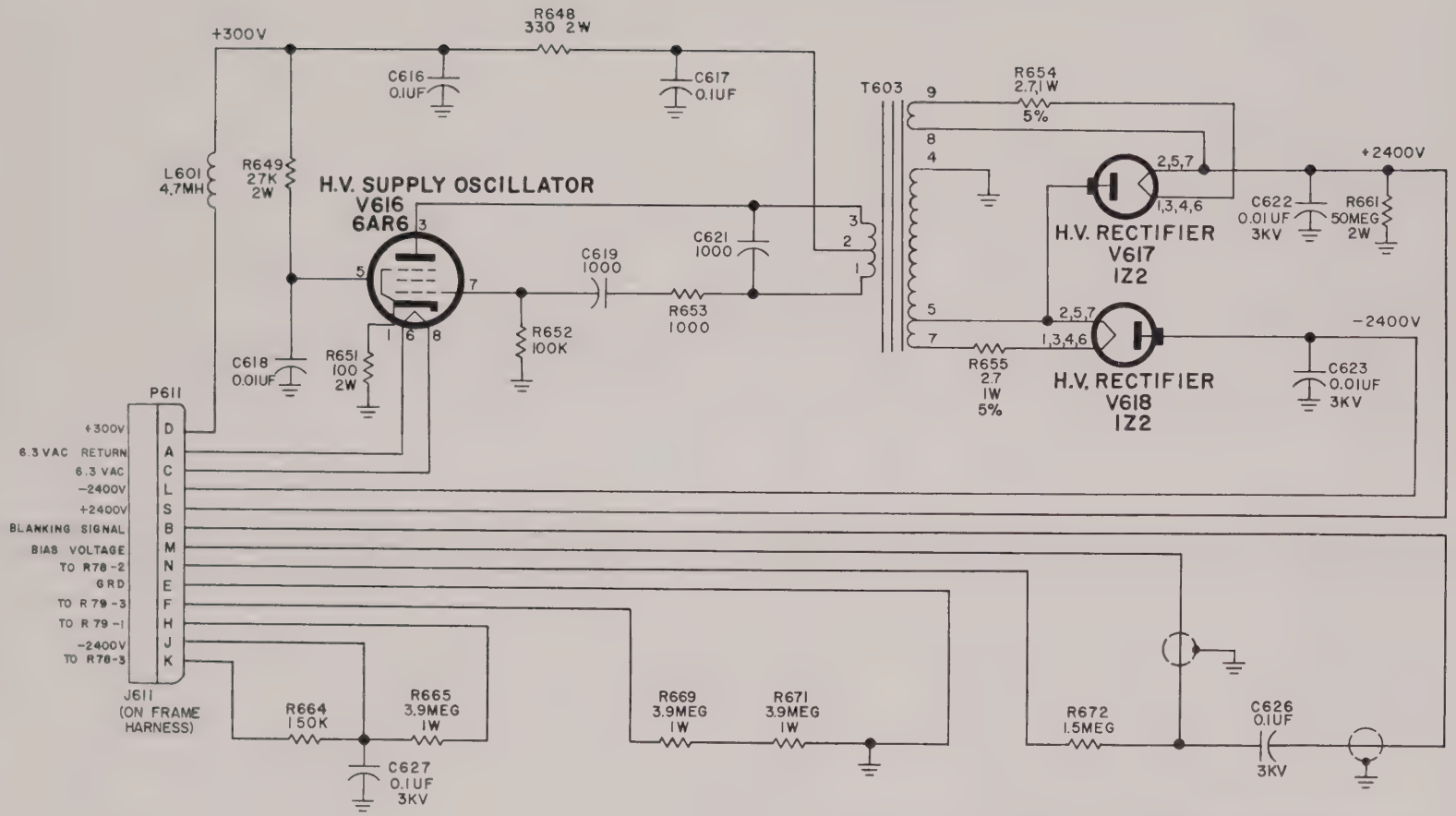
RESISTORS ARE RATED AT ±10%, 1/2 WATT, UNLESS OTHERWISE INDICATED

▭ INDICATES EQUIPMENT PANEL MARKING

⊘ INDICATES SCREWDRIVER ADJUSTMENT

RUN 7 AND UP

Figure 5-3. Klystron and Low Voltage Power Supplies, Schematic Diagram



NOTE: ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF), MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.

CAPACITORS ARE RATED AT ±10%, 400 VDCW, UNLESS OTHERWISE INDICATED.

INDUCTORS ARE RATED AT ±20%, 1000 VDC TEST, UNLESS OTHERWISE INDICATED.

RESISTORS ARE RATED AT ±10%, 1/2 WATT, UNLESS OTHERWISE INDICATED.

▭ INDICATES EQUIPMENT PANEL MARKING.

⊘ INDICATES SCREWDRIVER ADJUSTMENT.

8130 RUN 6 AND UP

Figure 5-4. CRT Power Supply, Schematic Diagram

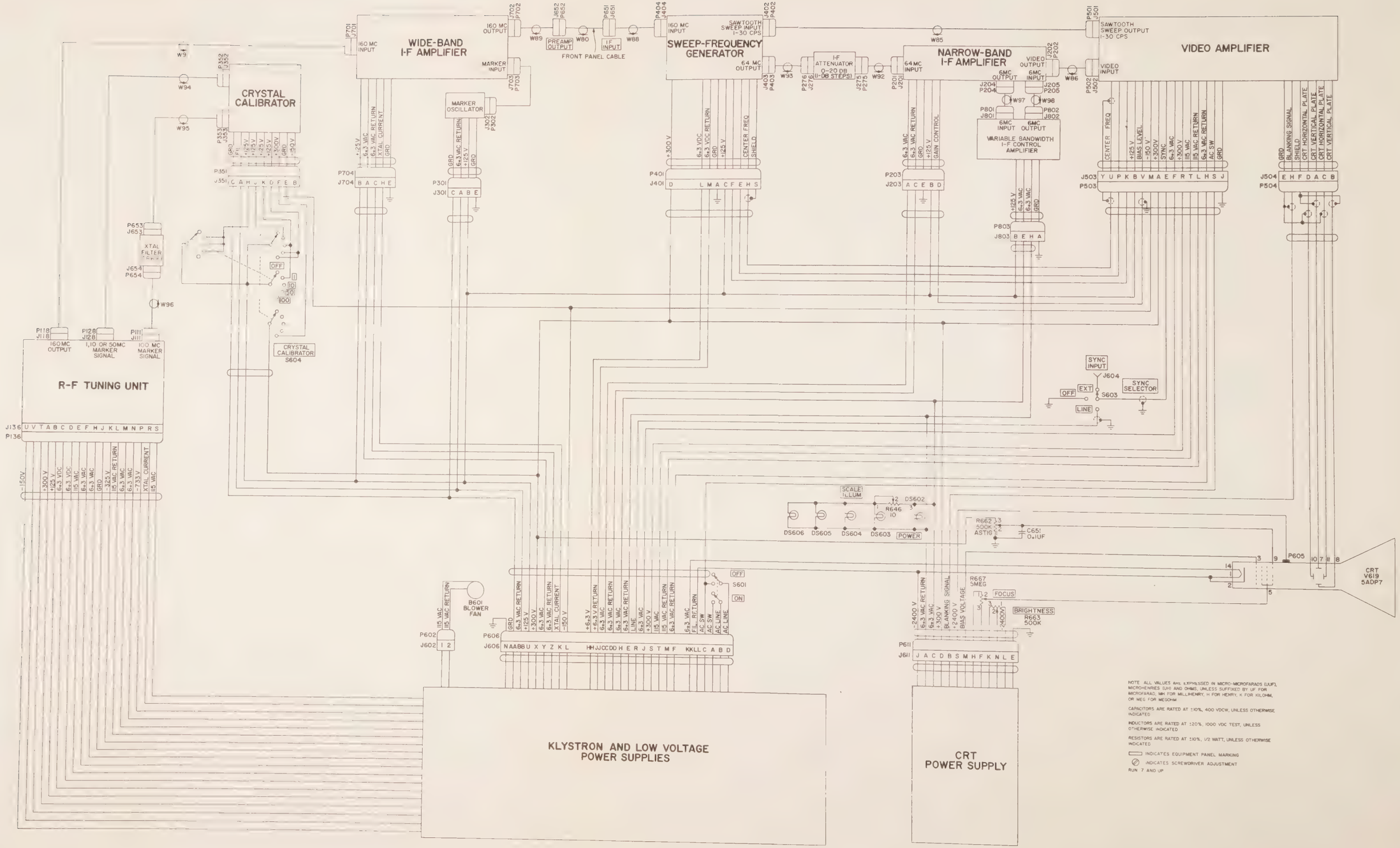

CRYSTAL CALIBRATOR
WIDE-BAND I-F AMPLIFIER
MARKER OSCILLATOR
SWEEP-FREQUENCY GENERATOR
I-F ATTENUATOR 0-20 DB (1-DB STEPS)
NARROW-BAND I-F AMPLIFIER
VIDEO AMPLIFIER
VARIABLE BANDWIDTH I-F CONTROL AMPLIFIER
R-F TUNING UNIT
XTAL FILTER
CRYSTAL CALIBRATOR S604
SYNC SELECTOR
KLYSTRON AND LOW VOLTAGE POWER SUPPLIES
CRT POWER SUPPLY
B601 BLOWER FAN
S601
SCALE ILLUM
POWER
FOCUS
BRIGHTNESS
CRT V619 5ADP7
FRONT PANEL CABLE
NOTE: ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF), MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM
CAPACITORS ARE RATED AT ±10%, 400 VDCW, UNLESS OTHERWISE INDICATED
INDUCTORS ARE RATED AT ±20%, 1000 VDC TEST, UNLESS OTHERWISE INDICATED
RESISTORS ARE RATED AT ±10%, 1/2 WATT, UNLESS OTHERWISE INDICATED
INDICATES EQUIPMENT PANEL MARKING
INDICATES SCREWDRIVER ADJUSTMENT
RUN 7 AND UP

Figure 5-5. Interchassis Cabling Diagram

SECTION VI

PARTS LIST

6-1. INTRODUCTION.

6-2. This parts list provides an alpha-numerical listing, in reference symbol sequence of the replaceable electrical, certain electro-mechanical, and mechanical parts of the equipment.

6-3. ORDERING INFORMATION. Orders for parts should contain the following information:

a. Equipment name and model.
b. Serial number.
c. Reference symbol of part.
d. Manufacturer's part number and code.

6-4. HOW TO USE THE PARTS LIST.

6-5. An explanation of the structure of the parts list, Table 6-2, and the meaning of the entries in the five columns are given in the following paragraphs. (See Figure 6-1.)

1 2 3 4 5 6 7

TABLE 6-1. PARTS LIST

SECTION VI
PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
B1 AND B2	BATTERY,DRY,1.5VDC	7S036	CQ	2
C1	CAPACITOR,MICA,220UUF,5 PCT,300WVDC	CM15C221J	AU	1
C2	CAPACITOR,PAPER,1UF,20 PCT,400WVDC	620M	AC	1
C3	NOT USED			
C4	CAPACITOR,PAPER,0.033UF,10 PCT,600WVDC	6TM-S33	BN	1
C5	SAME AS C1			
C6 THRU C9	CAPACITOR,MICA,51UUF,5 PCT,500WVDC	CM20C510J	AU	1
F1 AND F2	FUSE,CARTRIDGE,DELAY,5AMP,3AG	313005	AP	2
H1	KNOB,RANGE SELECTOR	70-5-2G	BH	1

Figure 6-1. Parts List Example

6-6. REFERENCE SYMBOL COLUMN. The reference symbol column (1, Figure 6-1) contains the reference symbol assigned to each part, which also identifies the part on the schematic diagram or in an illustration. The listing is in alpha-numerical order.

6-7. DESCRIPTION COLUMN. The description column (2) contains the description for each part. When the same part is used more than once in the equipment, the second and subsequent listings for that part use the phrase "SAME AS ___" (4) in the description column and the remaining columns (5, 6, and 7) are left blank. When a reference symbol designation has not been used or its assignment has been cancelled, the description column contains the phrase "NOT USED" (3).

6-8. MANUFACTURER'S PART NUMBER COLUMN. The manufacturer's part number column (5) contains the part number assigned by the manufacturer of the part, except for "SAME AS ___" and "NOT USED" listings.

6-9. MANUFACTURER'S CODE COLUMN. The manufacturer's code column (6) contains a letter code identifying the manufacturer of the part. Table 6-1 contains a listing of the letter codes and the manufacturers names and addresses.

6-10. MAINTENANCE QUANTITY COLUMN. The maintenance quantity column (7) contains the recommended maintenance quantity for each part, based on a one year requirement for an equipment in operation for 10 hours a day throughout the year. The recommended maintenance quantities will provide a high degree of equipment reliability in areas where an adequate supply of replacement parts is not available. The recommended maintenance quantity is listed for the initial occurrence of the part in the parts list, but covers all subsequent listings.

6-11. To determine recommended maintenance quantity for periods other than one year, multiply the one-year quantity by the desired period, expressed in years.

6-12. To determine recommended maintenance quantity for operating periods other than 10 hours per day, use the equation given below.

$$MQ' = MQ \times \frac{HR_{op}}{10}$$

where: MQ = Maintenance quantity from Table 6-1

MQ' = Maintenance quantity for desired operating period

HR_{op} = Operating period in hours

Round off the quantity obtained to the nearest whole number.

TABLE 6-1. MANUFACTURER'S CODE

CODE	NAME AND ADDRESS
A	Aeronautical Standards Group, Dept. of Navy & Air Force, Washington, D.C.
B	Aerovox Corp., New Bedford, Mass.
C	Alden Products Co., Brockton, Mass.
D	Allen-Bradley Co., Milwaukee, Wis.
E	Amperite Co., New York, N.Y.
F	Amphenol Connector Division of Amphenol-Borg Electronics Corp., Chicago, Ill.
G	Belden Mfg. Co., Chicago, Ill.
H	Bendix Semiconductor Division of Bendix Corp., Holmdel, N.J.
J	Birnbach Radio Co., New York, N.Y.
K	Birtcher Corp., Los Angeles, Calif.
L	Boston Gear Works Division of Murray Co. of Texas, Boston, Mass.
M	Shallcross Mfg. Co., Selma, N.C.
N	Bourns Laboratories, Inc., Riverside, Calif.
P	Centralab Division of Globe-Union, Inc., Milwaukee, Wis.
Q	Chatam Electronics Division of Tung-Sol Electric, Inc., Livingston, N.J.
R	Cinch Mfg. Co., Division of United-Carr Fastener Corp., Chicago, Ill.
S	Clarostat Mfg. Co., Inc., Dover, N.H.
T	Condenser Products Co., Brooksville, Fla.
U	Cornell-Dubilier Electric Corp., Newark, N.J.
V	Dialight Corp., Brooklyn, N.Y.
W	Eby, S.E., Co., Philadelphia, Pa.
X	Elco Corp., Philadelphia, Pa.
Y	Erie Resistor Corp., Erie, Pa.
Z	General Electric Co., Miniature Lamp Department of Lamp Division of Consumer Products Group, Cleveland, Ohio
AA	General Electric Co., Semi-Conductor Products Department of Electronic Components Division of Electronic, Atomic and Defense Systems Group, Syracuse, N.Y.
AB	General Transistor Western Corp., Los Angeles, Calif.
AC	Good-All Electric Mfg. Co., Ogallala, Nebr.
AD	Hammarlund Co., Inc., New York, N.Y.
AE	Harvey Hubbell, Inc., Bridgeport, Conn.
AF	Helipot Division of Beckman Instruments,Inc., Fullerton, Calif.
AG	Hopkins Engineering Co., San Fernando, Calif.
AH	Hughes Products Division of Hughes Aircraft Co., Newport Beach, Calif.
AJ	International Resistance Co., Philadelphia, Pa.
AK	Jan Hardware Mfg. Co., Inc., Long Island City, N.Y.
AL	JBT Instruments Inc., New Haven, Conn.
AM	Kenyon Transformer Co., Inc., Jersey City, N.J.
AN	Kurman Electric Co., Inc., Brooklyn, N.Y.
AP	Littelfuse, Inc., Des Plaines, Ill.
AQ	Mallory Battery Co., North Tarrytown, N.Y.
AR	Mendelsohn Speed Gun Co., Haskell, N.J.
AS	James Millen Mfg. Co., Inc., Malden, Mass.
AT	J.W. Miller Co., Los Angeles, Calif.
AU	Military Specifications
AV	Military Standards
AW	Minor Rubber Co., Inc., Bloomfield, N.J.
AX	Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.
AY	New Departure Division of General Motors Corp., Bristol, Conn.
AZ	Ohmite Mfg. Co., Skokie, Ill.
BA	Patton MacGuyer Co., Providence, R.I.
BB	Parker Kalon Division of General American Transportation Corp., Clifton, N.J.
BC	Pic Design Corp., East Rockaway, N.Y.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
BD	Plastic Capacitors, Inc., Chicago, Ill.
BE	Polarad Electronics Corp., Long Island City, N.Y.
BF	Potter and Brumfield Division of American Machine and Foundry Co., Princeton, Ind.
BG	Pyramid Electric Co., Darlington, S.C.
BH	Raytheon Co., Industrial Components Division, Industrial Tube Operation, Newton, Mass.
BJ	RCA Semiconductor and Materials Division of Radio Corp. of America, Somerville, N.J.
BK	Ripley Co., Inc., Middletown, Conn.
BL	Sangamo Electric Co., Springfield, Ill.
BM	Shakeproof Division of Illinois Tool Works, Elgin, Ill.
BN	Sprague Electric Co., North Adams, Mass.
BP	Staver Co., Inc., Bay Shore, Long Island, N.Y.
BQ	Sterling Transformer Corp., Brooklyn, N.Y.
BR	Technitrol Engineering Co., Philadelphia, Pa.
BS	Telewave Laboratories, Inc., Long Island City, N.Y.
BT	Times Facsimile Corp., New York, N.Y.
BU	Transitron Electronic Corp., Wakefield, Mass.
BV	Ucinite Co., Newtonville, Mass.
BW	United Transformer Co., New York, N.Y.
BX	Utah Radio Products Corp., Huntington, Ind.
BY	Vector Mfg. Co., Houston, Tex.
BZ	Victory Engineering Corp., Springfield, N.J.
CA	Waldes Kohinoor, Inc., Long Island City, N.Y.
CB	Weckesser Co., Chicago, Ill.
CC	Winchester Electronics Co., Inc., Norwalk, Conn.
CD	Cutler-Hammer, Inc., Milwaukee, Wis.
CE	Olsen Machine and Tool Co., North Abington, Mass.
CF	Cannon Electric Co., Los Angeles, Calif.
CG	Arco Electronics, Inc., Great Neck, N.Y.
CH	Cambridge Thermionic Corp., Cambridge, Mass.
CJ	Sylvania Electric Products, Inc., Semiconductor Division, Woburn, Mass.
CK	Commercially Available Component
CL	Stackpole Carbon Co., St. Marys, Pa.
CM	Astron Co., East Newark, N.J.
CN	Sarkes Tarzian, Inc., Bloomington, Ind.
CP	Arrow Hart and Hegeman Electric Co., Hartford, Conn.
CQ	Radio Corp. of America, New York, N.Y.
CR	Allied Control Co., Inc., New York, N.Y.
CS	Sylvania Electric Products, Inc., New York, N.Y.
CT	Leach Corp., Leach Relay Co. Division, Los Angeles, Calif.
CU	Triplett Electrical Instrument Co., Bluffton, Ohio
CV	Bliley Electric Co., Inc., Erie, Pa.
CW	Switchcraft, Inc., Chicago, Ill.
CX	Industrial Products Co., Division of Amphenol-Borg Electronics Corp., Danbury, Conn.
CY	Mepco Division of Sessions Clock Co., Morristown, N.J.
CZ	Resistance Products Co., Harrisburg, Pa.
DA	Continental-Wirt Electronics Corp., Philadelphia, Pa.
DB	Ward Leonard Electric Co., Mount Vernon, N.Y.
DC	Superex Electronics Corp., Yonkers, N.Y.
DD	Oak Mfg. Co., Crystal Lake, Ill.
DE	National Radio Co., Inc., Malden, Mass.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
DF	Wright Electronics, Inc., Kansas City, Mo.
DG	Torrington Mfg. Co., Torrington, Conn.
DH	Union Electronics, Long Island City, N. Y.
DJ	Applied Research, Inc., Port Washington, N. Y.
DK	Ferroxcube Corp. of America, Saugerties, N. Y.
DL	Technology Instrument Corp., Acton, Mass.
DM	Allen B. DuMont Laboratories, Inc., New York, N. Y.
DN	Amperex Electronic Co., Division of North American Philips Co., Inc., Hicksville, N. Y.
DP	Industrial Condenser Corp., Chicago, Ill.
DQ	International Rectifier Corp., El Segundo, Calif.
DR	CTS Corp., Elkhart, Ind.
DS	General Radio Co., West Concord, Mass.
DT	Microlab, Inc., Livingston, N. J.
DU	Comar Electric Co., Chicago, Ill.
DV	Film Capacitors, Inc., New York, N. Y.
DW	FXR Division of Amphenol-Borg Electronics Corp., Danbury, Conn.
DX	Britton Electronics Corp., Mount Vernon, N. Y.
DY	Chicago Standard Transformer Corp., Chicago, Ill.
DZ	Mallory, P. R., and Co., Inc., Indianapolis, Ind.
EA	Automatic Metal Products Co., Brooklyn, N. Y.
EB	Dale Electronics, Inc., Columbus, Nebr.
EC	Gulton Industries, Inc., Metuchen, N. J.
ED	International Electronic Industries, Inc., Nashville, Tenn.
EE	Clairtron Mfg. Co., Orange, N. J.
EF	Technical Apparatus Builders, New York, N. Y.
EG	Bussmann Fuse Division of McGraw-Edison Co., St. Louis, Mo.
EH	The Superior Electric Co., Bristol, Conn.
EJ	Rotron Mfg. Co., Inc., Woodstock, N. Y.
EK	Jeffers Electronics Division of Speer Carbon Co., DuBois, Pa.
EL	JFD Electronics Corp., Brooklyn, N. Y.
EM	Essex Electronics Division of Nytronics Inc., Berkeley Heights, N. J.
EN	Torotel, Inc., Kansas City, Mo.
EP	Texas Instruments Inc., Dallas, Texas
EQ	Wells Electronics Co., South Bend, Ind.
ER	Thordarson-Meissner Division of Maguire Industries, Inc., Mount Carmel, Ill.
ES	Piezo Crystal Co., Carlisle, Pa.
ET	Pacific Semiconductors, Inc., Hawthorne, Calif.
EV	Fasco Industries, Inc., Rochester, N. Y.
EW	Triad Transformer Corp., Venice, Calif.
EX	National Tel Tronics Corp., Yonkers, N. Y.
EY	Carling Electric, Inc., Hartford, Conn.
EZ	E. F. Johnson Co., Waseca, Minn.
FA	Thomas Electronics, Inc., Passaic, N. J.
FB	Merit Coil and Transformer Corp., Hollywood, Fla.
FC	Aladdin Electronics Division of Aladdin Industries, Inc., Nashville, Tenn.
FE	Sperry Semiconductor Division of Sperry Rand Corp., Norwalk, Conn.
FF	Corning Glass Works, Electronic Components Department, Bradford, Pa.
FG	Duncan Electronics, Inc., Santa Ana, Calif.
FH	Advance Electronics Laboratories, Inc., Passaic, N. J.
FJ	Fastex Division of Illinois Tool Works, Des Plaines, Ill.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
FK	Motorola, Inc., Semiconductor Products Division, Phoenix, Ariz.
FL	Electro Motive Mfg. Co., Willimantic, Conn.
FM	Varian Associates, Palo Alto, Calif.
FN	Quality Components, Inc., St. Marys, Pa.
FP	Automatic Mfg. Corp., Newark, N.J.
FQ	Electra Mfg. Co., Kansas City, Mo.
FR	Dage Electric Co., Inc., Beech Grove, Ind.
FS	The Cornish Wire Co., New York, N.Y.
FT	RLC Electronics, Inc., Mamaroneck, N.Y.
FU	Fairchild Camera and Instrument Corp., Semiconductor Division, Mountain View, Calif.
FV	Burnell and Co., Inc., Pelham Manor, N.Y.
FW	Dearborn Electronic Laboratories, Inc., Orlando, Fla.
FX	Weston Instruments, Division of Daystrom, Inc., Newark, N.J.
FY	HI-Q Division of Aerovox Corp., Myrtle Beach, S.C.
FZ	Electric Regulator Corp., South Norwalk, Conn.
GA	Simpson Electric Co., Chicago, Ill.
GB	Control Switch Division, Controls Co. of America, Chicago, Ill.
GC	Semicon, Inc., Bedford, Mass.
GD	Filtron Co., Inc., Flushing, Long Island, N.Y.
GE	Rotating Components, Inc., Brooklyn, N.Y.
GF	Transco Products, Inc., Los Angeles, Calif.
GG	Thompson Ramo Wooldridge, Inc., Cleveland, Ohio
GH	PRD Electronics, Inc., Brooklyn, N.Y.
GJ	Solitron Devices, Inc., Norwood, N.J.
GK	Valpey Crystal Co., Holliston, Mass.
GL	Sage Laboratories, Inc., Natick, Mass.
GM	J.H. Williams and Co., Buffalo, N.Y.
GN	Kings Electronics Co., Inc., Tuckahoe, N.Y.
GP	ITT Federal Division of International Telephone and Telegraph Corp., Clifton, N.J.
GQ	Herman H. Smith, Inc., Brooklyn, N.Y.
GR	Leecraft Mfg. Co., Inc., New York, N.Y.

SECTION VI

PARTS LIST

6-1. INTRODUCTION.

6-2. This parts list provides an alpha-numerical listing, in reference symbol sequence of the replaceable electrical, certain electro-mechanical, and mechanical parts of the equipment.

6-3. ORDERING INFORMATION. Orders for parts should contain the following information:

a. Equipment name and model.
b. Serial number.
c. Reference symbol of part.
d. Manufacturer's part number and code.

6-4. HOW TO USE THE PARTS LIST.

6-5. An explanation of the structure of the parts list, Table 6-2, and the meaning of the entries in the five columns are given in the following paragraphs. (See Figure 6-1.)

1 2 3 4 5 6 7

TABLE 6-1. PARTS LIST

SECTION VI
PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
B1 AND B2	BATTERY,DRY,1.5VDC	VS036	CQ	2
C1	CAPACITOR,MICA,220UUF,5 PCT,300WVDC	CM15C221J	AU	1
C2	CAPACITOR,PAPER,.1UF,20 PCT,400WVDC	620M	AC	1
C3	NOT USED			
C4	CAPACITOR,PAPER,0.033UF,10 PCT,600WVDC	6TM-S33	BN	1
C5	SAME AS C1			
C6 THRU C9	CAPACITOR,MICA,51UUF,5 PCT,500WVDC	CM20C510J	AU	1
F1 AND F2	FUSE,CARTRIDGE,DELAY,5AMP,3AG	313005	AP	2
H1	KNOB,RANGE SELECTOR	70-5-2G	BH	1

Figure 6-1. Parts List Example

6-6. REFERENCE SYMBOL COLUMN. The reference symbol column (1, Figure 6-1) contains the reference symbol assigned to each part, which also identifies the part on the schematic diagram or in an illustration. The listing is in alpha-numerical order.

6-7. DESCRIPTION COLUMN. The description column (2) contains the description for each part. When the same part is used more than once in the equipment, the second and subsequent listings for that part use the phrase "SAME AS ___" (4) in the description column and the remaining columns (5, 6, and 7) are left blank. When a reference symbol designation has not been used or its assignment has been cancelled, the description column contains the phrase "NOT USED" (3).

6-8. MANUFACTURER'S PART NUMBER COLUMN. The manufacturer's part number column (5) contains the part number assigned by the manufacturer of the part, except for "SAME AS ___" and "NOT USED" listings.

6-9. MANUFACTURER'S CODE COLUMN. The manufacturer's code column (6) contains a letter code identifying the manufacturer of the part. Table 6-1 contains a listing of the letter codes and the manufacturers names and addresses.

6-10. MAINTENANCE QUANTITY COLUMN. The maintenance quantity column (7) contains the recommended maintenance quantity for each part, based on a one year requirement for an equipment in operation for 10 hours a day throughout the year. The recommended maintenance quantities will provide a high degree of equipment reliability in areas where an adequate supply of replacement parts is not available. The recommended maintenance quantity is listed for the initial occurrence of the part in the parts list, but covers all subsequent listings.

6-11. To determine recommended maintenance quantity for periods other than one year, multiply the one-year quantity by the desired period, expressed in years.

6-12. To determine recommended maintenance quantity for operating periods other than 10 hours per day, use the equation given below.

$$MQ' = MQ \times \frac{HR_{op}}{10}$$

where: MQ = Maintenance quantity from Table 6-1

MQ' = Maintenance quantity for desired operating period

HR_{op} = Operating period in hours

Round off the quantity obtained to the nearest whole number.

TABLE 6-1. MANUFACTURER'S CODE

CODE	NAME AND ADDRESS
A	Aeronautical Standards Group, Dept. of Navy & Air Force, Washington, D. C.
B	Aerovox Corp., New Bedford, Mass.
C	Alden Products Co., Brockton, Mass.
D	Allen-Bradley Co., Milwaukee, Wis.
E	Amperite Co., New York, N. Y.
F	Amphenol Connector Division of Amphenol-Borg Electronics Corp., Chicago, Ill.
G	Belden Mfg. Co., Chicago, Ill.
H	Bendix Semiconductor Division of Bendix Corp., Holmdel, N. J.
J	Birnbach Radio Co., New York, N. Y.
K	Birtcher Corp., Los Angeles, Calif.
L	Boston Gear Works Division of Murray Co. of Texas, Boston, Mass.
M	Shallcross Mfg. Co., Selma, N. C.
N	Bourns Laboratories, Inc., Riverside, Calif.
P	Centralab Division of Globe-Union, Inc., Milwaukee, Wis.
Q	Chatam Electronics Division of Tung-Sol Electric, Inc., Livingston, N. J.
R	Cinch Mfg. Co., Division of United-Carr Fastener Corp., Chicago, Ill.
S	Clarostat Mfg. Co., Inc., Dover, N. H.
T	Condenser Products Co., Brooksville, Fla.
U	Cornell-Dubilier Electric Corp., Newark, N. J.
V	Dialight Corp., Brooklyn, N. Y.
W	Eby, S. E., Co., Philadelphia, Pa.
X	Elco Corp., Philadelphia, Pa.
Y	Erie Resistor Corp., Erie, Pa.
Z	General Electric Co., Miniature Lamp Department of Lamp Division of Consumer Products Group, Cleveland, Ohio
AA	General Electric Co., Semi-Conductor Products Department of Electronic Components Division of Electronic, Atomic and Defense Systems Group, Syracuse, N. Y.
AB	General Transistor Western Corp., Los Angeles, Calif.
AC	Good-All Electric Mfg. Co., Ogallala, Nebr.
AD	Hammarlund Co., Inc., New York, N. Y.
AE	Harvey Hubbell, Inc., Bridgeport, Conn.
AF	Helipot Division of Beckman Instruments,Inc., Fullerton, Calif.
AG	Hopkins Engineering Co., San Fernando, Calif.
AH	Hughes Products Division of Hughes Aircraft Co., Newport Beach, Calif.
AJ	International Resistance Co., Philadelphia, Pa.
AK	Jan Hardware Mfg. Co., Inc., Long Island City, N. Y.
AL	JBT Instruments Inc., New Haven, Conn.
AM	Kenyon Transformer Co., Inc., Jersey City, N. J.
AN	Kurman Electric Co., Inc., Brooklyn, N. Y.
AP	Littelfuse, Inc., Des Plaines, Ill.
AQ	Mallory Battery Co., North Tarrytown, N. Y.
AR	Mendelsohn Speed Gun Co., Haskell, N. J.
AS	James Millen Mfg. Co., Inc., Malden, Mass.
AT	J. W. Miller Co., Los Angeles, Calif.
AU	Military Specifications
AV	Military Standards
AW	Minor Rubber Co., Inc., Bloomfield, N. J.
AX	Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.
AY	New Departure Division of General Motors Corp., Bristol, Conn.
AZ	Ohmite Mfg. Co., Skokie, Ill.
BA	Patton MacGuyer Co., Providence, R. I.
BB	Parker Kalon Division of General American Transportation Corp., Clifton, N. J.
BC	Pic Design Corp., East Rockaway, N. Y.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
BD	Plastic Capacitors, Inc., Chicago, Ill.
BE	Polarad Electronics Corp., Long Island City, N.Y.
BF	Potter and Brumfield Division of American Machine and Foundry Co., Princeton, Ind.
BG	Pyramid Electric Co., Darlington, S.C.
BH	Raytheon Co., Industrial Components Division, Industrial Tube Operation, Newton, Mass.
BJ	RCA Semiconductor and Materials Division of Radio Corp. of America, Somerville, N.J.
BK	Ripley Co., Inc., Middletown, Conn.
BL	Sangamo Electric Co., Springfield, Ill.
BM	Shakeproof Division of Illinois Tool Works, Elgin, Ill.
BN	Sprague Electric Co., North Adams, Mass.
BP	Staver Co., Inc., Bay Shore, Long Island, N.Y.
BQ	Sterling Transformer Corp., Brooklyn, N.Y.
BR	Technitrol Engineering Co., Philadelphia, Pa.
BS	Telewave Laboratories, Inc., Long Island City, N.Y.
BT	Times Facsimile Corp., New York, N.Y.
BU	Transitron Electronic Corp., Wakefield, Mass.
BV	Ucinite Co., Newtonville, Mass.
BW	United Transformer Co., New York, N.Y.
BX	Utah Radio Products Corp., Huntington, Ind.
BY	Vector Mfg. Co., Houston, Tex.
BZ	Victory Engineering Corp., Springfield, N.J.
CA	Waldes Kohinoor, Inc., Long Island City, N.Y.
CB	Weckesser Co., Chicago, Ill.
CC	Winchester Electronics Co., Inc., Norwalk, Conn.
CD	Cutler-Hammer, Inc., Milwaukee, Wis.
CE	Olsen Machine and Tool Co., North Abington, Mass.
CF	Cannon Electric Co., Los Angeles, Calif.
CG	Arco Electronics, Inc., Great Neck, N.Y.
CH	Cambridge Thermionic Corp., Cambridge, Mass.
CJ	Sylvania Electric Products, Inc., Semiconductor Division, Woburn, Mass.
CK	Commercially Available Component
CL	Stackpole Carbon Co., St. Marys, Pa.
CM	Astron Co., East Newark, N.J.
CN	Sarkes Tarzian, Inc., Bloomington, Ind.
CP	Arrow Hart and Hegeman Electric Co., Hartford, Conn.
CQ	Radio Corp. of America, New York, N.Y.
CR	Allied Control Co., Inc., New York, N.Y.
CS	Sylvania Electric Products, Inc., New York, N.Y.
CT	Leach Corp., Leach Relay Co. Division, Los Angeles, Calif.
CU	Triplett Electrical Instrument Co., Bluffton, Ohio
CV	Bliley Electric Co., Inc., Erie, Pa.
CW	Switchcraft, Inc., Chicago, Ill.
CX	Industrial Products Co., Division of Amphenol-Borg Electronics Corp., Danbury, Conn.
CY	Mepco Division of Sessions Clock Co., Morristown, N.J.
CZ	Resistance Products Co., Harrisburg, Pa.
DA	Continental-Wirt Electronics Corp., Philadelphia, Pa.
DB	Ward Leonard Electric Co., Mount Vernon, N.Y.
DC	Superex Electronics Corp., Yonkers, N.Y.
DD	Oak Mfg. Co., Crystal Lake, Ill.
DE	National Radio Co., Inc., Malden, Mass

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
DF	Wright Electronics, Inc., Kansas City, Mo.
DG	Torrington Mfg. Co., Torrington, Conn.
DH	Union Electronics, Long Island City, N.Y.
DJ	Applied Research, Inc., Port Washington, N.Y.
DK	Ferroxcube Corp. of America, Saugerties, N.Y.
DL	Technology Instrument Corp., Acton, Mass.
DM	Allen B. DuMont Laboratories, Inc., New York, N.Y.
DN	Amperex Electronic Co., Division of North American Philips Co., Inc., Hicksville, N.Y.
DP	Industrial Condenser Corp., Chicago, Ill.
DQ	International Rectifier Corp., El Segundo, Calif.
DR	CTS Corp., Elkhart, Ind.
DS	General Radio Co., West Concord, Mass.
DT	Microlab, Inc., Livingston, N.J.
DU	Comar Electric Co., Chicago, Ill.
DV	Film Capacitors, Inc., New York, N.Y.
DW	FXR Division of Amphenol-Borg Electronics Corp., Danbury, Conn.
DX	Britton Electronics Corp., Mount Vernon, N.Y.
DY	Chicago Standard Transformer Corp., Chicago, Ill.
DZ	Mallory, P.R., and Co., Inc., Indianapolis, Ind.
EA	Automatic Metal Products Co., Brooklyn, N.Y.
EB	Dale Electronics, Inc., Columbus, Nebr.
EC	Gulton Industries, Inc., Metuchen, N.J.
ED	International Electronic Industries, Inc., Nashville, Tenn.
EE	Clairtron Mfg. Co., Orange, N.J.
EF	Technical Apparatus Builders, New York, N.Y.
EG	Bussmann Fuse Division of McGraw-Edison Co., St. Louis, Mo.
EH	The Superior Electric Co., Bristol, Conn.
EJ	Rotron Mfg. Co., Inc., Woodstock, N.Y.
EK	Jeffers Electronics Division of Speer Carbon Co., DuBois, Pa.
EL	JFD Electronics Corp., Brooklyn, N.Y.
EM	Essex Electronics Division of Nytronics Inc., Berkeley Heights, N.J.
EN	Torotel, Inc., Kansas City, Mo.
EP	Texas Instruments Inc., Dallas, Texas
EQ	Wells Electronics Co., South Bend, Ind.
ER	Thordarson-Meissner Division of Maguire Industries, Inc., Mount Carmel, Ill.
ES	Piezo Crystal Co., Carlisle, Pa.
ET	Pacific Semiconductors, Inc., Hawthorne, Calif.
EV	Fasco Industries, Inc., Rochester, N.Y.
EW	Triad Transformer Corp., Venice, Calif.
EX	National Tel Tronics Corp., Yonkers, N.Y.
EY	Carling Electric, Inc., Hartford, Conn.
EZ	E.F. Johnson Co., Waseca, Minn.
FA	Thomas Electronics, Inc., Passaic, N.J.
FB	Merit Coil and Transformer Corp., Hollywood, Fla.
FC	Aladdin Electronics Division of Aladdin Industries, Inc., Nashville, Tenn.
FE	Sperry Semiconductor Division of Sperry Rand Corp., Norwalk, Conn.
FF	Corning Glass Works, Electronic Components Department, Bradford, Pa.
FG	Duncan Electronics, Inc., Santa Ana, Calif.
FH	Advance Electronics Laboratories, Inc., Passaic, N.J.
FJ	Fastex Division of Illinois Tool Works, Des Plaines, Ill.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
FK	Motorola, Inc., Semiconductor Products Division, Phoenix, Ariz.
FL	Electro Motive Mfg. Co., Willimantic, Conn.
FM	Varian Associates, Palo Alto, Calif.
FN	Quality Components, Inc., St. Marys, Pa.
FP	Automatic Mfg. Corp., Newark, N.J.
FQ	Electra Mfg. Co., Kansas City, Mo.
FR	Dage Electric Co., Inc., Beech Grove, Ind.
FS	The Cornish Wire Co., New York, N.Y.
FT	RLC Electronics, Inc., Mamaroneck, N.Y.
FU	Fairchild Camera and Instrument Corp., Semiconductor Division, Mountain View, Calif.
FV	Burnell and Co., Inc., Pelham Manor, N.Y.
FW	Dearborn Electronic Laboratories, Inc., Orlando, Fla.
FX	Weston Instruments, Division of Daystrom, Inc., Newark, N.J.
FY	HI-Q Division of Aerovox Corp., Myrtle Beach, S.C.
FZ	Electric Regulator Corp., South Norwalk, Conn.
GA	Simpson Electric Co., Chicago, Ill.
GB	Control Switch Division, Controls Co. of America, Chicago, Ill.
GC	Semicon, Inc., Bedford, Mass.
GD	Filtron Co., Inc., Flushing, Long Island, N.Y.
GE	Rotating Components, Inc., Brooklyn, N.Y.
GF	Transco Products, Inc., Los Angeles, Calif.
GG	Thompson Ramo Wooldridge, Inc., Cleveland, Ohio
GH	PRD Electronics, Inc., Brooklyn, N.Y.
GJ	Solitron Devices, Inc., Norwood, N.J.
GK	Valpey Crystal Co., Holliston, Mass.
GL	Sage Laboratories, Inc., Natick, Mass.
GM	J.H. Williams and Co., Buffalo, N.Y.
GN	Kings Electronics Co., Inc., Tuckahoe, N.Y.
GP	ITT Federal Division of International Telephone and Telegraph Corp., Clifton, N.J.
GQ	Herman H. Smith, Inc., Brooklyn, N.Y.
GR	Leecraft Mfg. Co., Inc., New York, N.Y.

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	MODELS SA-84W & SA-84WA SPECTRUM ANALYZERS			
AT101	ATTENUATOR ASSY,LF,PART OF A111			
AT102	ATTENUATOR ASSY,HF,PART OF A111			
AT201	ATTENUATOR ASSY	C126624	BE	1
AT301	ATTENUATOR ASSY	B128291	BE	1
A101	MODEL SA-84WA TUNING UNIT ASSY	D147732	BE	1
A102	MIXER ASSY	A147805	BE	1
A103	REAR PLATE ASSY	D147847	BE	1
A104	FRONT PANEL ASSY	D147849	BE	1
A105	SIGNAL SAMPLER	BHYN-10	DT	1
A106	165MC LOW-PASS FILTER ASSY	C142967	BE	1
A107	LOW-FREQUENCY OSCILLATOR ASSY	C147842	BE	1
A108	OSCILLATOR ASSY,RF,400-800MC	B146630	BE	1
A109	MIXER AND CONNECTOR ASSY	A147781	BE	1
A110	OSCILLATOR ASSY	C147824	BE	1
A111	ATTENUATOR AND DRIVE ASSY	C133153	BE	1
A201	NARROW BAND ASSY	D137221	BE	1
A301	MARKER OSCILLATOR ASSY	D128297	BE	1
A302	CRYSTAL CALIBRATOR ASSY	D128005	BE	1
A401	SWEEPER ASSY	D128004	BE	1
A501	VIDEO ASSY	D132283	BE	1
A502	RESISTOR AND SWITCH ASSY	C111709	BE	1
A601	CRT SUPPLY ASSY	D128757	BE	1
A602	CRYSTAL FILTER ASSY	B135344	BE	1
A701	WIDE BAND ASSY	D126910	BE	1
A801	CONTROL AMPLIFIER ASSY	D141460	BE	1
A802 THRU A849	NOT USED			
A850	160MC PREAMPLIFIER ASSY	C146109	BE	1
B601	FAN ASSY,AXIAL,115VAC,50-60CPS	C146653	BE	1
B601	FAN ASSY,AXIAL,115VAC,50-1000CPS, USED ON MODEL SA-84WAF ONLY	B103377	BE	1
B601A	MOTOR,FAN,SYNCHRONOUS,115VAC,50-60CPS, PART OF B601	B22146	BE	1
B601B	IMPELLER,CCW,REAR MOUNTED HUB,PART OF B601 /POLARAD PART NO. B706977	0-5527-5	DG	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
B601C	BRACKET ASSY,PART OF B601, USED ON MODEL SA-84WAF ONLY	C147103	BE	1
CP101	COAXIAL AND ADAPTER ASSY	A147839	BE	1
CP102	ADAPTER ASSY	A147648	BE	1
CP103	ADAPTER ASSY,N TYPE	C147853	BE	1
CP601	CONNECTOR,ADAPTER,UHF TO BNC,PART OF A602	UG-273/U	AU	1
CR101	SEMICONDUCTOR DEVICE,DIODE,GERMANIUM	1N69	CK	15
CR102	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL	1N415E	CK	5
CR103	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL	1N26A	CK	5
CR104	SEMICONDUCTOR DEVICE,DIODE	61-1501	DQ	5
CR105 THRU CR108	SEMICONDUCTOR DEVICE,DIODE,SILICON /POLARAD PART NO. B707117/ USED ON MODEL SA-84WAF ONLY	CER71	GJ	99
CR109	SEMICONDUCTOR DEVICE,DIODE,ZENER /POLARAD PART NO. A702520	1.5M9.1Z10	FK	5
CR201	SAME AS CR101			
CR401	NOT USED			
CR402	SEMICONDUCTOR DEVICE,DIODE,GERMANIUM	1N82A	CK	5
CR501	SAME AS CR101			
CR502 THRU CR508	SEMICONDUCTOR DEVICE,DIODE,GERMANIUM	1N198	CK	35
CR509 AND CR510	NOT USED			
CR511 AND CR512	SAME AS CR105,USED ON MODEL SA-84WAF ONLY			
CR601 THRU CR612	SAME AS CR105			
CR613	SEMICONDUCTOR DEVICE,DIODE,GERMANIUM /POLARAD PART NO. A701867	4JA211AB1AC1	AA	5
CR614	SEMICONDUCTOR DEVICE,DIODE,SILICON	1N1341	CK	5
CR615	SEMICONDUCTOR DEVICE,DIODE	1N2970A	CK	5
CR616	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL, PART OF A602	1N23C	CK	5
CR617 AND CR618	SAME AS CR105,USED ON MODEL SA-84WAF ONLY			
C101	CAPACITOR,PAPER,0.1UF,20 PCT,600WVDC /POLARAD PART NO. B508928	330601	BL	1
C102 AND C103	NOT USED			
C104 AND C105	CAPACITOR,MICA,1000UUF,10 PCT,300WVDC	CB21QD102K	AU	1
C106 THRU C114	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C115	CAPACITOR,NON-REPLACEABLE PART OF A108			
C116	CAPACITOR,NON-REPLACEABLE PART OF A108			
C117	CAPACITOR,NON-REPLACEABLE PART OF A108			
C118	CAPACITOR,NON-REPLACEABLE PART OF A108			
C119	CAPACITOR,NON-REPLACEABLE PART OF MP103			
C120	CAPACITOR,NON-REPLACEABLE PART OF MP103			
C121 THRU C124	NOT USED			
C125	CAPACITOR,VARIABLE,CERAMIC,2-12UUF,500WVDC /POLARAD PART NO. A701519	PCST-50	CH	1
C126	CAPACITOR,CERAMIC,33UUF,2 PCT,500WVDC	CC20SH330G	AU	1
C127	SAME AS C125			
C128	CAPACITOR,CERAMIC,5UUF,0.25UUF TOL,500WVDC	CC20CH050C	AU	1
C129	SAME AS C125			
C130	SAME AS C126			
C131 AND C132	SAME AS C125			
C133	SAME AS C126			
C134 AND C135	SAME AS C125			
C136	CAPACITOR,VARIABLE,CERAMIC,1.5-7UUF,350WVDC, NON-REPLACEABLE PART OF A108			
C137	CAPACITOR ASSY,CONSISTING OF MP102 AND MP103, NON-REPLACEABLE PART OF A103			
C138	CAPACITOR ASSY,CONSISTING OF MP101 AND PART OF A108,NON-REPLACEABLE PART OF A103			
C201	CAPACITOR,MICA,56UUF,5 PCT,300WVDC	CM15C560J	AU	1
C202 AND C203	CAPACITOR,CERAMIC,1000UUF,10 PCT,1000WVDC /POLARAD PART NO. A701560	DD-102	P	3
C204	CAPACITOR,MICA,1000UUF,10 PCT,500WVDC /POLARAD PART NO. B706815	370FC102K	Y	1
C205	CAPACITOR,MICA,43UUF,5 PCT,300WVDC	CM15C430J	AU	1
C206 AND C207	SAME AS C202			
C208	CAPACITOR,CERAMIC,0.01UF,GMV,600WVDC /POLARAD PART NO. B705176	DD6-103	P	2
C209	SAME AS C202			
C210	NOT USED			
C211	CAPACITOR,MICA,120UUF,5 PCT,500WVDC /POLARAD PART NO. B703086	DM15F121J	FL	1
C212	SAME AS C202			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C213	NOT USED			
C214	SAME AS C208			
C215	NOT USED			
C216 AND C217	SAME AS C202			
C218 AND C219	SAME AS C208			
C220	NOT USED			
C221	CAPACITOR,MICA,330UUF,5 PCT,300WVDC	CM15C331J	AU	1
C222	SAME AS C204			
C223	SAME AS C202			
C224	CAPACITOR,MICA,180UUF,5 PCT,500WVDC /POLARAD PART NO. B703090	DM15F181J	FL	1
C225	CAPACITOR,MICA,1500UUF,5 PCT,500WVDC	CM30E152J	AU	1
C226	SAME AS C204			
C227	CAPACITOR,MICA,47UUF,10 PCT,500WVDC /POLARAD PART NO. B703022	DM15E470K	FL	1
C228 AND C229	SAME AS C208			
C230	NOT USED			
C231 THRU C233	SAME AS C208			
C234	SAME AS C221			
C235	SAME AS C202			
C236 THRU C239	SAME AS C208			
C240 AND C241	NOT USED			
C242 AND C243	SAME AS C208			
C244	CAPACITOR,CERAMIC,FEED-THRU,1000UUF, 20 PCT,500WVDC/POLARAD PART NO. A506409	327-102	Y	2
C245	SAME AS C221			
C246	SAME AS C202			
C247	SAME AS C208			
C248	SAME AS C244			
C249	CAPACITOR,CERAMIC,51UUF,2 PCT,300WVDC	CC21UJ510G	AU	1
C250 AND C251	NOT USED			
C252	SAME AS C244			
C253	CAPACITOR,MICA,22UUF,10 PCT,500WVDC	CM15E220K	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C254	SAME AS C227			
C255	SAME AS C202			
C301	CAPACITOR,CERAMIC,820UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK60V821K	AU	1
C302	CAPACITOR,MICA,68UUF,10 PCT,300WVDC	CB11BX680K	AU	1
C303 AND C304	CAPACITOR,VARIABLE,CERAMIC,2-12UUF,500WVDC /POLARAD PART NO. A107118	CST-50	CH	1
C305	NOT USED			
C306	CAPACITOR,VARIABLE,AIR DIELECTRIC, 3.35-22.5UUF,1.25 PCT	A128292	BE	1
C307	CAPACITOR,CERAMIC,51UUF,5 PCT,500WVDC	CC30CH510J	AU	1
C308	CAPACITOR,CERAMIC,1000UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK60Y102Z	AU	1
C309 THRU C350	NOT USED			
C351 AND C352	SAME AS C244			
C353	SAME AS C202			
C354	CAPACITOR,MICA,100UUF,5 PCT,300WVDC	CM15C101J	AU	1
C355	SAME AS C202			
C356	CAPACITOR,MICA,10UUF,10 PCT,300WVDC	CM15B100K	AU	1
C357	CAPACITOR,MICA,5UUF,5 PCT,300WVDC	CM15C050J	AU	1
C358 AND C359	SAME AS C202			
C360	SAME AS C227			
C361 AND C362	SAME AS C104			
C363	NOT USED			
C364	SAME AS C202			
C365	SAME AS C303			
C366	CAPACITOR,MICA,1000UUF,10 PCT,300WVDC	CB21QB102K	AU	1
C367 THRU C369	NOT USED			
C370 THRU C374	SAME AS C244			
C375	SAME AS C202			
C376	SAME AS C303			
C377	NOT USED			
C378	SAME AS C356			
C379 AND C380	CAPACITOR,CERAMIC,820UF,2 PCT,500WVDC	CC32CG820G	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C381	SAME AS C354			
C382	CAPACITOR,MICA,150UUF,5 PCT,300WVDC	CM15C151J	AU	1
C383	SAME AS C244			
C384 THRU C387	SAME AS C202			
C388	CAPACITOR,CERAMIC,22UUF,2 PCT,500WVDC	CC20CH220G	AU	1
C389	SAME AS C366			
C390	SAME AS C202			
C401	NOT USED			
C402	SAME AS C244			
C403	NOT USED			
C404	CAPACITOR,CERAMIC,27UUF,2 PCT,500WVDC	CC20SH270G	AU	1
C405	CAPACITOR,CERAMIC,1UUF,10 PCT,500WVDC /POLARAD PART NO. B701922	GA-1	CL	1
C406	SAME AS C244			
C407 THRU C410	NOT USED			
C411 AND C412	CAPACITOR,CERAMIC,47UUF,2 PCT,500WVDC	CC20UJ470G	AU	1
C413	SAME AS C244			
C414	CAPACITOR,CERAMIC,4.7UUF,10 PCT,500WVDC /POLARAD PART NO. B701930	GA-4.7	CL	1
C415	SAME AS C201			
C416	SAME AS C202			
C417	SAME AS C201			
C418 THRU C421	SAME AS C361			
C422 THRU C426	SAME AS C244			
C427	SAME AS C202			
C428	SAME AS C405			
C429	NOT USED			
C430 THRU C432	SAME AS C202			
C433	CAPACITOR,CERAMIC,0.1UF,PLUS 80 PCT, MINUS 20 PCT,500WVDC/POLARAD PART NO. A702290	41C92	BN	1
C434	NOT USED			
C435	SAME AS C433			
C436	CAPACITOR,CERAMIC,3.3UUF,10 PCT,500WVDC /POLARAD PART NO. B701928	GA-3.3	CL	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C437	NOT USED			
C438	CAPACITOR,ELECTROLYTIC,8UF,10 PCT,450WVDC /POLARAD PART NO. B703544	BR8-450	U	1
C439	SAME AS C204			
C440 AND C441	SAME AS C202			
C442	SAME AS C439			
C443 AND C444	SAME AS C202			
C445 THRU C454	NOT USED			
C455	CAPACITOR,CERAMIC,0.01UF,GMV,1000WVDC /POLARAD PART NO. B705177	DD-103	P	1
C501	SAME AS C361			
C502	CAPACITOR,PLASTIC,0.1UF,10 PCT,400WVDC /POLARAD PART NO. B508828	4TM-P10	BN	1
C503	CAPACITOR,PLASTIC,0.022UF,10 PCT,400WVDC	4TM-S22	BN	1
C504	CAPACITOR,PLASTIC,0.02UF,10 PCT,400WVDC	4TM-S20	BN	1
C505	CAPACITOR,PLASTIC,0.05UF,10 PCT,400WVDC /POLARAD PART NO. B508825	4TM-S50	BN	1
C506	CAPACITOR,PAPER,1UF,10 PCT,600WVDC	CP61BFF105K	AU	1
C507	CAPACITOR,PLASTIC,0.01UF,10 PCT,400WVDC	4TM-S10	BN	1
C508	SAME AS C433			
C509	CAPACITOR,MICA,330UF,5 PCT,300WVDC	CM15C330J	AU	1
C510	NOT USED			
C511	CAPACITOR,MICA,150UF,5 PCT,300WVDC	CM15C150J	AU	1
C512	CAPACITOR,VARIABLE,CERAMIC,7-450UF,500WVDC	CV11C450	AU	1
C513	SAME AS C433			
C514	CAPACITOR,PAPER,1UF,PLUS 20 PCT, MINUS 10 PCT,200WVDC/POLARAD PART NO. B508735	330210	BL	1
C515	NOT USED			
C516	CAPACITOR,CERAMIC,0.03UF,PLUS 80 PCT, MINUS 20 PCT,600WVDC/POLARAD PART NO. B705179	DD-303	P	1
C601	CAPACITOR,ELECTROLYTIC,4UF,1500WVDC	7115-4	BL	1
C602	CAPACITOR,ELECTROLYTIC,0.5UF,1000WVDC	7110-.5	BL	1
C603	CAPACITOR,PLASTIC,0.05UF,10 PCT,600WVDC	6TM-S50	BN	1
C604	CAPACITOR,CERAMIC,0.05UF,PLUS 80 PCT, MINUS 20 PCT,500WVDC/POLARAD PART NO. A70-514	41C105	BN	1
C605	CAPACITOR,ELECTROLYTIC,2UF,1000WVDC	7110-2	BL	1
C606 AND C607	CAPACITOR,ELECTROLYTIC,DUAL SECT, 40UF,450WVDC,EACH SECT	17D15	BN	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C608	CAPACITOR,PLASTIC,0.25UF,10 PCT,200WVDC	2TM-P25	BN	1
C609	CAPACITOR,PAPER,2UF,10 PCT,600WVDC	CP53B1EF205K	AU	1
C610	NOT USED			
C611	SAME AS C609			
C612 AND C613	SAME AS C606			
C614	SAME AS C604			
C615	NOT USED			
C616 AND C617	SAME AS C433			
C618	SAME AS C455			
C619	SAME AS C202			
C620	NOT USED			
C621	CAPACITOR,MICA,1000UUF,10 PCT,1000WVDC	VCM20B102K	U	1
C622 AND C623	CAPACITOR,CERAMIC,0.01UF,3000WVDC /POLARAD PART NO. A700582	41C121A2	BN	1
C624	SAME AS C603			
C625	CAPACITOR,ELECTROLYTIC,4UF,450WVDC /POLARAD PART NO. C511352	TVA-1702	BN	1
C626 AND C627	CAPACITOR,MYLAR,0.1UF,5 PCT,3000WVDC	D6-30-100	DV	1
C628	SAME AS C625			
C629	SAME AS C202			
C630	NOT USED			
C631	SAME AS C625			
C632 AND C633	CAPACITOR,ELECTROLYTIC,2000UF,15WVDC /POLARAD PART NO. B706319	BR200015	U	1
C634	SAME AS C514			
C635	CAPACITOR,ELECTROLYTIC,2UF,450WVDC /POLARAD PART NO. A702295	BR245	U	1
C636 AND C637	SAME AS C632			
C638	NOT USED			
C639	SAME AS C609			
C640 THRU C650	NOT USED			
C651	SAME AS C433			
C652 THRU C664	NOT USED			
C665	CAPACITOR,PAPER,0.5UF,10 PCT,600WVDC, USED ON MODEL SA-84WAF ONLY	CP54B1EF504K	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C701 THRU C705	CAPACITOR,CERAMIC,1000UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK61Y102Z	AU	3
C706	SAME AS C439			
C707 THRU C727	SAME AS C701			
C728 THRU C730	SAME AS C244			
C731 THRU C738	NOT USED			
C739	CAPACITOR,CERAMIC,0.56UUF,10 PCT,500WVDC /POLARAD PART NO. B701919	GA-.56	CL	1
C740	NOT USED			
C741	SAME AS C303			
C801	CAPACITOR,CERAMIC,TEMPERATURE COMPENSATING, 51UUF,0.5UUF TOL,600WVDC	TCN-51	P	1
C802 AND C803	CAPACITOR,VARIABLE,CERAMIC,3-13UUF,500WVDC	CV11A130	Y	1
C804 THRU C806	CAPACITOR,CERAMIC,0.01UF,20 PCT,1000WVDC	5HK-S10	BN	1
C807	SAME AS C244			
C808	SAME AS C804			
C809 AND C810	SAME AS C202			
C811	SAME AS C804			
C812	SAME AS C244			
C813 THRU C850	NOT USED			
C851	CAPACITOR,CERAMIC,1000UUF,GMV,500WVDC, WITH LOCKWASHER M6347 AND NUT M6369 /POLARAD PART NO. B706421	SB4A-102W	D	1
C852	SAME AS C202			
C853 AND C854	SAME AS C851			
C855	CAPACITOR,VARIABLE,GLASS,0.8-8.5UUF,1000WVDC /POLARAD PART NO. B702810	VC20G	EL	1
C856	SAME AS C851			
C857	SAME AS C202			
C858	SAME AS C851			
C859	SAME AS C202			
DS101 THRU DS104	LAMP,INCANDESCENT,6-8V,BAYONET BASE /POLARAD PART NO. 005237	47	CK	10
DS601	NOT USED			
DS602	LAMP,INCANDESCENT,6V,MIDGET FLANGE BASE	328	CK	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
DS603 THRU DS606	SAME AS DS101			
E301 AND E302	TERMINATION, CABLE	MX-1684/U	AU	1
FE101 THRU FE108	FERRITE BEAD/POLARAD PART NO. A115516	56-590-65/3B	DK	2
FE201 THRU FE203	SAME AS FE101			
FE301	SAME AS FE101			
FE302 THRU FE350	NOT USED			
FE351 THRU FE355	SAME AS FE101			
FE401 THRU FE406	SAME AS FE101			
FE701 THRU FE705	SAME AS FE101			
FE801 AND FE802	SAME AS FE101			
FL101 THRU FL103	FILTER, RF, 25000UF, 20 PCT, 500WVDC, WITH LOCKWASHER M6355 AND NUT M6328 /POLARAD PART NO. A700354	FIB-A	D	1
FL301 AND FL302	SAME AS FL101			
FL501	FILTER, RF, PART OF A602	FH2001	DT	1
FL801 THRU FL850	NOT USED			
FL851 AND FL852	FILTER, RF, FEED-THRU, WITH LOCKWASHER M6351 AND NUT M6377/POLARAD PART NO. A701510	SMFB-A2	D	1
F601 AND F602	FUSE, CARTRIDGE, DELAY, 6-1/4 AMP, 3AG /POLARAD PART NO. B704813	MDL6-1/4	EG	10
F603	FUSE, CARTRIDGE, DELAY, 4 AMPS, 3AG /POLARAD PART NO. B704814	MDL4	EG	5
F604	FUSE, CARTRIDGE, 2 AMP, 3AG /POLARAD PART NO. 518111	F02G2R00A	AU	5
H1	KNOB, UNI-DIAL TUNING/POLARAD PART NO. 507302	175-6-2	BH	1
H2	KNOB/POLARAD PART NO. 507403	70-5-2	BH	1
H3	KNOB/POLARAD PART NO. 517202	90-1-2	BH	1
H4	KNOB/POLARAD PART NO. 517212	90-3-2	BH	1
H5 AND H6	KNOB	A138359	BE	1
H7 AND H8	KNOB	A115356	BE	1
H9 THRU H11	KNOB/POLARAD PART NO. 517206	70-2-2	BH	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
H12 THRU H14	KNOB	A138396	BE	1
H15 AND H16	KNOB	A132300	BE	1
H17 AND H18	KNOB/POLARAD PART NO. A701234	70-1WD-3	BH	1
H19 THRU H22	KNOB/POLARAD PART NO. 517211	70-3-2	BH	1
H23	KNOB/POLARAD PART NO. 507301	125-6-2	BH	1
J101	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, NON-REPLACEABLE PART OF A109			
J102	CONNECTOR,RECEPTACLE,FEMALE,N TYPE	UG-22B/U	AU	1
J103 AND J104	CONNECTOR,RECEPTACLE,FEMALE,N TYPE	UG-10958/U	AU	1
J105	CONNECTOR,RECEPTACLE,FEMALE,N TYPE NON-REPLACEABLE PART OF A111			
J106	SAME AS J103			
J107	CONNECTOR,RECEPTACLE,FEMALE, NON-REPLACEABLE PART OF A102			
J108	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-625/U	AU	2
J109	NOT USED			
J110	CONNECTOR,RECEPTACLE,FEMALE,N TYPE, NON-REPLACEABLE PART OF A102			
J111 AND J112	NOT USED			
J113	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, WITH 2F MTG PLATE/POLARAD PART NO. A701331/ PART OF A111	671-1-2F	FR	1
J114	SAME AS J103			
J115 THRU J123	NOT USED			
J124	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, NON-REPLACEABLE PART OF A109			
J125	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, NON-REPLACEABLE PART OF A109			
J126	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-447/U	AU	1
J127 AND J128	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-909/U	AU	1
J129 THRU J135	NOT USED			
J136	CONNECTOR,RECEPTACLE,MALE,18 PINS /POLARAD PART NO. 516013	SA18P	CC	1
J137	JACK,TIP,RED/POLARAD PART NO. 541401	110BCS	C	1
J138	JACK,TIP,BLUE/POLARAD PART NO. 541402	110BCS	C	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
J201 AND J202	SAME AS J108			
J203	CONNECTOR,RECEPTACLE,FEMALE,7 PINS /POLARAD PART NO. 516005	A7S	CC	1
J204 AND J205	SAME AS J108			
J206 THRU J274	NOT USED			
J275 AND J276	SAME AS J108			
J301	SAME AS J203			
J302	SAME AS J108			
J303 THRU J350	NOT USED			
J351	CONNECTOR,RECEPTACLE,FEMALE,14 PINS /POLARAD PART NO. 516106	MRE-14S-G	CC	1
J352 AND J353	SAME AS J108			
J401	CONNECTOR,RECEPTACLE,FEMALE,15 PINS /POLARAD PART NO. 516007	A15S	CC	1
J402 THRU J404	SAME AS J108			
J501 AND J502	SAME AS J108			
J503	CONNECTOR,RECEPTACLE,MALE,26 PINS	MRE-26P-G	CC	1
J504	SAME AS J203			
J601	CONNECTOR,RECEPTACLE,MALE,3 PINS /POLARAD PART NO. A700010	7486	AE	1
J602	CONNECTOR,PLUG,MALE,3 PINS /POLARAD PART NO. AK50123	91-MPM3S	F	1
J603	CONNECTOR,RECEPTACLE,FEMALE,8 PINS	TS101P01	AU	1
J604	SAME AS J108			
J605	NOT USED			
J606	CONNECTOR,RECEPTACLE,FEMALE,34 PINS	MRE-34S-G	CC	1
J607	NOT USED			
J608	SAME AS J108			
J609 AND J610	NOT USED			
J611	SAME AS J401			
J612 THRU J650	NOT USED			
J651 AND J652	SAME AS J127			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
J653	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, NON-REPLACEABLE PART OF A602			
J654	CONNECTOR,RECEPTACLE,MALE,N TYPE, NON-REPLACEABLE PART OF FL501			
J701 THRU J703	SAME AS J108			
J704	SAME AS J203			
J801	SAME AS J203			
J802	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE,RT.ANGLE	UG-1098/U	AU	1
J803	CONNECTOR,RECEPTACLE,FEMALE,5 PINS /POLARAD PART NO. C509729	M5S-LRN	CC	1
J804 THRU J850	NOT USED			
J851	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-290/U	AU	1
J852	SAME AS J802			
K101 THRU K104	RELAY,ARMATURE,SPDT,115VAC,60CPS /POLARAD PART NO. B137913	316-010102-8	DW	1
K501	RELAY,ARMATURE,3PDT,110VAC /POLARAD PART NO. A135339	XM-310	DU	1
K601	RELAY,ARMATURE,DPDT,115VAC	B0-6A115	CR	1
K602	RELAY,THERMAL,DELAY,SPST,115VAC	115N060T	E	1
L101	COIL,RF	A138422	BE	1
L102	COIL,RF,NON-REPLACEABLE PART OF A107			
L103	CHOKE,RF,NON-REPLACEABLE PART OF A102			
L104	COIL,RF	A138425	BE	1
L105 THRU L107	NOT USED			
L108	COIL,RF,NON-REPLACEABLE PART OF A108			
L109	COIL,RF,NON-REPLACEABLE PART OF A108			
L110	COIL,RF,NON-REPLACEABLE PART OF A108			
L111	COIL,RF,NON-REPLACEABLE PART OF A109			
L112 THRU L124	NOT USED			
L125	COIL,RF,0.071UH	A142971	BE	1
L126	COIL,RF,0.077UH	A142961	BE	1
L127 AND L128	COIL,RF,0.061UH	A147126	BE	1
L129 AND L130	COIL,RF,0.064UH	A142969	BE	1
L131	SAME AS L125			
L132	COIL,RF,0.077UH	A142962	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
L133	COIL•RF•0.055UH	A142963	BE	1
L134	COIL•RF•0.085UH	A142964	BE	1
L135 THRU L140	NOT USED			
L141	COIL•RF•VARIABLE•NON-REPLACEABLE PART OF A108			
L201	NOT USED			
L202	COIL•RF•VARIABLE	A100969	BE	1
L203	COIL•RF•5UH	A100676	BE	1
L204	NOT USED			
L205	COIL•RF•VARIABLE	A100822	BE	1
L206	NOT USED			
L207	COIL•RF•50UH	A101170	BE	1
L208	NOT USED			
L209	COIL•RF•VARIABLE	A111193	BE	1
L210	NOT USED			
L211	COIL•RF•100UH	A101169	BE	1
L212	SAME AS L203			
L213	COIL•RF	A100970	BE	1
L214	NOT USED			
L215	SAME AS L203			
L216	SAME AS L209			
L217 AND L218	SAME AS L211			
L219	SAME AS L209			
L220	NOT USED			
L221	SAME AS L211			
L222	COIL•RF•2.5MH/POLARAD PART NO. A106494	R50-2.5	DE	1
L223	SAME AS L211			
L224	NOT USED			
L225	COIL•RF•VARIABLE	A146633		
L301	NOT USED			
L302	COIL•RF	A103756	BE	1
L303	COIL•RF•13UH	A103757	BE	1
L304	NOT USED			
L305	COIL•RF•VARIABLE	A137231	BE	1
L306	COIL•RF•INDUCTIVELY COUPLED TO L305	D128297-49	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
L307 THRU L350	NOT USED			
L351	COIL,RF,VARIABLE	A127652	BE	1
L352	COIL,RF,VARIABLE	A127653	BE	1
L353	COIL,RF,VARIABLE	A127654	BE	1
L354	COIL,RF,VARIABLE	A127986	BE	1
L355	COIL,RF,VARIABLE	A127987	BE	1
L356 THRU L359	COIL,RF,5UH	A114575	BE	1
L360	TRANSFORMER,RF	A128006	BE	1
L361	NOT USED			
L362	COIL,RF,5MH	M50	DC	1
L363	SAME AS L211			
L401	COIL,RF,10MH	A146621	BE	1
L402	NOT USED			
L403	REACTOR,INDUCTIVELY COUPLED TO L405	B111335	BE	1
L404	NOT USED			
L405	REACTOR,INDUCTIVELY COUPLED TO L403	A127996	BE	1
L406	COIL,RF,VARIABLE	A127659	BE	1
L407	COIL,RF	A127997	BE	1
L408	COIL,RF,VARIABLE	A127660	BE	1
L409	COIL,RF,VARIABLE	A131643	BE	1
L410 AND L411	COIL,RF,0.8UH	A100674	BE	1
L501	COIL,RF,2.5UH	M25	DC	1
L601	COIL,RF,4.7MH	R40-4.7	DE	1
L701	COIL,RF,VARIABLE	A127094	BE	1
L702	COIL,RF,VARIABLE	A127096	BE	1
L703	COIL,RF,VARIABLE	A127095	BE	1
L704	SAME AS L702			
L705	SAME AS L703			
L706	SAME AS L702			
L707	COIL,RF,VARIABLE	A127097	BE	1
L708	SAME AS L356			
L709	COIL,RF	A132585	BE	1
L710	COIL,RF	A127099	BE	1
L711	COIL,RF	A127098	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
L712	COIL,RF	A127101	BE	1
L713	SAME AS L711			
L714	SAME AS L712			
L715	SAME AS L711			
L716	SAME AS L712			
L717 AND L718	COIL,RF,0.6UH	A21030-3	BE	1
L719	COIL,RF	A144026	BE	1
L801 AND L802	NOT USED			
L803	COIL,RF,VARIABLE	B141448	BE	1
L804 THRU L806	SAME AS L207			
L807 THRU L850	NOT USED			
L851 AND L852	COIL,RF,4.7UH,10 PCT/POLARAD PART NO. B702559	10102-24	EK	1
L853	COIL,RF,VARIABLE	B146106	BE	1
L854	SAME AS L851			
MP1	FILTER,CRT,BLUE/POLARAD PART NO. B708102	100236	AK	1
MP2	BEZEL,CRT/POLARAD PART NO. B706528	C100231	AK	1
MP3	KLYSTRON COVER AND SOCKET ASSY	BK50146	BE	1
MP101	TUNING ROD ASSY,PART OF C137	A139043	BE	1
MP102	TUNING ROD ASSY,PART OF C138	A139044	BE	1
MP103	GLASS TUBE ASSY,PART OF C138	A138420	BE	1
M101	METER,0-1MA,DC,2 PCT TOL	B135346	BE	1
P101 THRU P106	NOT USED			
P107	CONNECTOR,PLUG,MALE, NON-REPLACEABLE PART OF CP102			
P108	CONNECTOR,PLUG,MALE,BNC TYPE	UG-88/U	AU	3
P109	CONNECTOR,PLUG,MALE,N TYPE	UG-536A/U	AU	1
P110	CONNECTOR,PLUG,MALE,N TYPE	UG-21B/U	AU	1
P111	CONNECTOR,PLUG,FEMALE,N TYPE	UG-602/U	AU	1
P112	CONNECTOR,PLUG,FEMALE,N TYPE	100N3000	EA	1
P113	CONNECTOR,PLUG,MALE,BNC TYPE	UG-88C/U	AU	1
P114	SAME AS P109			
P115	NOT USED			
P116 AND P117	SAME AS P108			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
P118	NOT USED			
P119	SAME AS P108			
P120	NOT USED			
P121 THRU P123	SAME AS P108			
P124 THRU P128	SAME AS P108			
P129 AND P130	NOT USED			
P131 THRU P133	SAME AS P108			
P134 AND P135	NOT USED			
P136	CONNECTOR,PLUG FEMALE,18 PINS,WITH HOOD	SA18S-H	CC	1
P137 THRU P151	NOT USED			
P152	SAME AS P108			
P201 AND P202	CONNECTOR,PLUG,MALE,BNC TYPE	UG-260/U	AU	2
P203 AND P204	SAME AS P108			
P205	CONNECTOR,PLUG,MALE,7 PINS,WITH HOOD	A7P-H	CC	1
P206 THRU P274	NOT USED			
P275 AND P276	SAME AS P201			
P301	SAME AS P205			
P302	SAME AS P108			
P303 THRU P350	NOT USED			
P351	CONNECTOR,PLUG,MALE,14 PINS,WITH HOOD	MRE-14P-G-H-1	CC	1
P352	SAME AS P108			
P353	SAME AS P201			
P401	CONNECTOR,PLUG,MALE,15 PINS,WITH HOOD	A15P-H	CC	1
P402 AND P403	SAME AS P201			
P404	SAME AS P108			
P501 AND P502	SAME AS P201			
P503	CONNECTOR,RECEPTACLE,FEMALE,26 PINS,WITH HOOD	MRE-26S-G-H-1	CC	1
P504	SAME AS P205			
P601	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
P602	CONNECTOR,PLUG,FEMALE,3 PINS /POLARAD PART NO. AK50124	91-MPF3S	F	1
P603 AND P604	NOT USED			
P605	CONNECTOR,PLUG,FEMALE,CRT ANODE /POLARAD PART NO. A701600	8657	R	1
P606	CONNECTOR,PLUG,MALE,34 PINS,WITH HOOD	MRE-34P-G-H	CC	1
P607 THRU P610	NOT USED			
P611	CONNECTOR,PLUG,MALE,15 PINS,WITH HOOD	A15P-H-1	CC	1
P612 THRU P650	NOT USED			
P651 AND P652	CONNECTOR,PLUG,MALE,BNC TYPE /POLARAD PART NO. A706211	8525	CX	1
P653	SAME AS P201			
P654	SAME AS P111			
P655	SAME AS P201			
P656	SAME AS P108			
P701 THRU P703	SAME AS P108			
P704	SAME AS P205			
P801 AND P802	SAME AS P108			
P803	CONNECTOR,PLUG,MALE,5 PINS,WITH HOOD H19C	M5P-LSH	CC	1
P804 THRU P850	NOT USED			
P851 AND P852	SAME AS P108			
Q601	TRANSISTOR,PNP TYPE	2N277	CK	1
Q801 THRU Q850	NOT USED			
Q851	SEMICONDUCTOR DEVICE,TRANSISTOR	2N700	CK	1
R101	RESISTOR,VARIABLE,COMPOSITION,10K,10 PCT,2W /POLARAD PART NO. 517849	RV4NAYSD103A	AU	1
R102	RESISTOR,VARIABLE,COMPOSITION,50K,10 PCT,2W /POLARAD PART NO. 517853	RV4NAYSD503A	AU	1
R103	RESISTOR,VARIABLE,WW,100K,2 PCT,10W	A121020	BE	1
R104	SAME AS R102			
R105	RESISTOR,COMPOSITION,120K,10 PCT,2W	RC42GF124K	AU	1
R106	RESISTOR,COMPOSITION,270K,10 PCT,1/2W	RC20GF274K	AU	1
R107	RESISTOR,COMPOSITION,100K,10 PCT,1/2W	RC20GF104K	AU	2
R108	RESISTOR,FILM,1.47 MEGO,1 PCT,2W	MDH-1.47MEG	AJ	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R109	RESISTOR•COMPOSITION•22K•10 PCT•1/2W	RC20GF223K	AU	1
R110	RESISTOR•FILM•MICROWAVE•50 OHMS•10 PCT•1/2W• /POLARAD PART NO• A544104/ NON-REPLACEABLE PART OF A109			
R111	RESISTOR•FILM•600K•1 PCT•1/2W	MDC-600K	AJ	1
R112	RESISTOR•FILM•250K•1 PCT•1/2W	MDC-250K	AJ	1
R113	RESISTOR•COMPOSITION•5•1K•5 PCT•1/2W	RC20GF512J	AU	1
R114	RESISTOR•COMPOSITION•8•2K•10 PCT•1/2W• NON-REPLACEABLE PART OF A108			
R115	RESISTOR•COMPOSITION•1•5K•10 PCT•1W	RC32GF152K	AU	1
R116	NOT USED			
R117	RESISTOR•COMPOSITION•390 OHMS•10 PCT•1/2W	RC20GF391K	AU	1
R118	RESISTOR•COMPOSITION•39 OHMS•10 PCT•1/2W	RC20GF390K	AU	1
R119	SAME AS R115			
R120	RESISTOR•COMPOSITION•8•2K•10 PCT•1/2W	RC20GF822K	AU	1
R121 AND R122	NOT USED			
R123	RESISTOR•COMPOSITION•100 OHMS•5 PCT•1/2W	RC20GF101J	BE	1
R124	RESISTOR•COMPOSITION•13K•5 PCT•2W	RC42GF133J	AU	1
R125	RESISTOR•COMPOSITION•15 OHMS•10 PCT•1/2W	RC20GF150K	AU	1
R126 AND R127	RESISTOR•COMPOSITION•270 OHMS•10 PCT•1/2W	RC20GF271K	AU	1
R128	SAME AS R124			
R129 AND R130	NOT USED			
R131 AND R132	RESISTOR•WW•500 OHMS•5W /POLARAD PART NO• B707528/ USED ON MODEL SA-84WAF ONLY	57E5015T8	BN	1
R133	SAME AS R105			
R201	RESISTOR•COMPOSITION•4•7K•10 PCT•1/2W	RC20GF472K	AU	1
R202	RESISTOR•COMPOSITION•10K•10 PCT•1/2W	RC20GF103K	AU	1
R203	RESISTOR•COMPOSITION•2•2K•10 PCT•1W	RC32GF222K	AU	1
R204	RESISTOR•COMPOSITION•100 OHMS•10 PCT•1/2W	RC20GF101K	AU	3
R205	RESISTOR•COMPSOITION•150 OHMS•10 PCT•1/2W	RC20GF151K	AU	1
R206	SAME AS R109			
R207	SAME AS R203			
R208	RESISTOR•COMPOSITION•10 OHMS•10 PCT•1/2W	RC20GF100K	AU	1
R209	SAME AS R205			
R210	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R211	SAME AS R109			
R212	RESISTOR•COMPOSITION•3•3K•10 PCT•1/2W	RC20GF332K	AU	1
R213	RESISTOR•COMPOSITION•220 OHMS•10 PCT•1/2W	RC20GF221K	AU	1
R214	RESISTOR•COMPOSITION•820 OHMS•10 PCT•1/2W	RC20GF821K	AU	1
R215	SAME AS R212			
R216	SAME AS R213			
R217	SAME AS R212			
R218	SAME AS R214			
R219	RESISTOR•COMPOSITION•33K•10 PCT•1/2W	RC20GF333K	AU	1
R220 THRU R223	NOT USED			
R224	NOT USED			
R225	SAME AS R107			
R226 THRU R274	NOT USED			
R275	RESISTOR•FILM•19•4 OHMS•1 PCT•1/4W	HF-10-19•4	CY	1
R276	RESISTOR•FILM•364•6 OHMS•1 PCT•1/4W	HF-10-364•6	CY	1
R277	RESISTOR•FILM•1•304K•1 PCT•1/4W	HF-10-1304	CY	1
R278	RESISTOR•FILM•8•65 OHMS•1 PCT•1/4W	HF-10-8•65	CY	1
R279	SAME AS R277			
R280	RESISTOR•FILM•654•3 OHMS•1 PCT•1/4W	HF-10-654•3	CY	1
R281	RESISTOR•FILM•17•42 OHMS•1 PCT•1/4W	HF-10-17•42	CY	1
R282	SAME AS R280			
R283	RESISTOR•FILM•438•5 OHMS•1 PCT•1/4W	HF-10-438•5	CY	1
R284	RESISTOR•FILM•26•42 OHMS•1 PCT•1/4W	HF-10-26•42	CY	1
R285	SAME AS R283			
R286	RESISTOR•FILM•331•5 OHMS•1 PCT•1/4W	HF-10-331•5	CY	1
R287	RESISTOR•FILM•35•77 OHMS•1 PCT•1/4W	HF-10-35•77	CY	1
R288	SAME AS R286			
R289	RESISTOR•FILM•144•3 OHMS•1 PCT•1/4W	HF-10-144•3	CY	1
R290	RESISTOR•FILM•106•7 OHMS•1 PCT•1/4W	HF-10-106•7	CY	1
R291	SAME AS R289			
R292	SAME AS R276			
R293	SAME AS R275			
R301	SAME AS R202			
R302	RESISTOR•COMPOSITION•470 OHMS•10 PCT•1/2W	RC20GF471K	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R303	RESISTOR•COMPOSITION•1•2K•5 PCT•1W	RC32GF122J	AU	1
R304	NOT USED			
R305	RESISTOR•VARIABLE•COMPOSITION•500 OHMS• 20 PCT•2W	A126281	BE	1
R306 THRU R350	NOT USED			
R351 AND R352	SAME AS R117			
R353	SAME AS R201			
R354	SAME AS R202			
R355	SAME AS R204			
R356	SAME AS R219			
R357	RESISTOR•COMPOSITION•220K•10 PCT•1/2W	RC20GF224K	AU	1
R358	SAME AS R109			
R359	RESISTOR•COMPOSITION•12K•10 PCT•1W	RC32GF123K	AU	1
R360 AND R361	SAME AS R208			
R362 AND R363	SAME AS R219			
R364	SAME AS R107			
R365	RESISTOR•COMPOSITION•6•8K•10 PCT•1/2W	RC20GF682K	AU	1
R366	SAME AS R107			
R367	NOT USED			
R368	RESISTOR•COMPOSITION•22K•10 PCT•1W	RC32GF223K	AU	1
R401	NOT USED			
R402	RESISTOR•WW•12K•5 PCT•5W /POLARAD PART NO• B706609	246E1235	BN	1
R403	RESISTOR•VARIABLE•COMPOSITION•50K•10 PCT•2W /POLARAD PART NO• 517853	RV4NAYSD503A	AU	1
R404	NOT USED			
R405	RESISTOR•COMPOSITION•150K•10 PCT•1/2W	RC20GF154K	AU	1
R406	SAME AS R357			
R407 THRU R410	NOT USED			
R411	RESISTOR•COMPOSITION•4•7K•10 PCT•2W	RC42GF472K	AU	1
R412	RESISTOR•COMPOSITION•1K•10 PCT•1/2W	RC20GF102K	AU	1
R413	RESISTOR•COMPOSITION•27K•10 PCT•1/2W	RC20GF273K	AU	1
R414 THRU R417	NOT USED			
R418 AND R419	SAME AS R413			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R420	RESISTOR,COMPOSITION,470 OHMS,10 PCT,1W	RC32GF471K	AU	1
R421	RESISTOR,COMPOSITION,1.5K,10 PCT,1/2W	RC20GF152K	AU	1
R422	RESISTOR,COMPOSITION,51 OHMS,5 PCT,1/2W	RC20GF510J	AU	1
R423	SAME AS R204			
R424	SAME AS R412			
R425	RESISTOR,COMPOSITION,100 OHMS,10 PCT,2W	RC42GF101K	AU	1
R426 THRU R431	NOT USED			
R432	RESISTOR,COMPOSITION,82 OHMS,5 PCT,1/2W	RC20GF820J	AU	1
R501	RESISTOR,COMPOSITION,12K,10 PCT,1/2W	RC20GF123K	AU	1
R502	RESISTOR,COMPOSITION,470K,10 PCT,1/2W	RC20GF474K	AU	2
R503	RESISTOR,COMPOSITION,120K,10 PCT,1/2W	RC20GF124K	AU	1
R504	RESISTOR,COMPOSITION,3.9 MEGO,10 PCT,1/2W	RC20GF395K	AU	1
R505	RESISTOR,VARIABLE,COMPOSITION,DUAL SECT, SECT A,1 MEGO,20 PCT,SECT B,25K,10 PCT, 1/2W BOTH SECT	A138397	BE	1
R506	SAME AS R204			
R507	SAME AS R219			
R508	RESISTOR,VARIABLE,COMPOSITION,50K,20 PCT,1/2W /POLARAD PART NO. B116362	X3537	DR	1
R509	RESISTOR,COMPOSITION,56K,10 PCT,1/2W	RC20GF563K	AU	1
R510	SAME AS R412			
R511	NOT USED			
R512	RESISTOR,VARIABLE,COMPOSITION,25K,20 PCT,1/2W /POLARAD PART NO. B116361	X3536	DR	1
R513	NOT USED			
R514	SAME AS R106			
R515	SAME AS R512			
R516	RESISTOR,COMPOSITION,18K,10 PCT,1/2W	RC20GF183K	AU	1
R517	RESISTOR,COMPOSITION,10K,10 PCT,2W	RC42GF103K	AU	1
R518	RESISTOR,COMPOSITION,47K,10 PCT,1/2W	RC20GF473K	AU	1
R519	SAME AS R109			
R520	RESISTOR,COMPOSITION,820 OHMS,10 PCT,2W, USED ON MODEL SA-84WAF ONLY	RC42GF821K	AU	1
R521	RESISTOR,COMPOSITION,680K,10 PCT,1/2W	RC20GF684K	AU	1
R522	RESISTOR,COMPOSITION,22K,10 PCT,2W	RC42GF223K	AU	1
R523	SAME AS R503			
R524	SAME AS R501			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R525	SAME AS R202			
R526 AND R527	RESISTOR,COMPOSITION,68K,10 PCT,2W	RC42GF683K	AU	1
R528	RESISTOR,VARIABLE,COMPOSITION,DUAL CONC, SECT A,50K,SECT B,1 MEGO, 20 PCT,1/2W,BOTH SECT	A133086	BE	1
R529	SAME AS R107			
R530	NOT USED			
R531	SAME AS R509			
R532	SAME AS R107			
R533	SAME AS R106			
R534	SAME AS R405			
R535	RESISTOR,COMPOSITION,68K,10 PCT,1/2W	RC20GF683K	AU	1
R536	RESISTOR,VARIABLE,COMPOSITION,1 MEGO, 20 PCT,1/2W/POLARAD PART NO. B116364	X3541	DR	1
R537	RESISTOR,VARIABLE,COMPOSITION,2.5 MEGO, 20 PCT,1/2W/POLARAD PART NO. B116365	X3542	DR	1
R538	RESISTOR,VARIABLE,COMPOSITION,100K,10 PCT,2W, NON-REPLACEABLE PART OF A502			
R539	SAME AS R302			
R540	NOT USED			
R541	RESISTOR,WW,4K,5 PCT,10W	10KT-4K	BN	1
R542	RESISTOR,COMPOSITION,2.7K,10 PCT,2W	RC42GF272K	AU	1
R543	SAME AS R503			
R544	RESISTOR,COMPOSITION,33K,10 PCT,1W	RC32GF333K	AU	1
R545	SAME AS R219			
R546	RESISTOR,COMPOSITION,1 MEGO,10 PCT,1/2W	RC20GF105K	AU	1
R547	RESISTOR,COMPOSITION,15K,10 PCT,1/2W	RC20GF153K	AU	1
R548	RESISTOR,COMPOSITION,2.2K,10 PCT,1/2W	RC20GF222K	AU	1
R549 THRU R551	NOT USED			
R552	RESISTOR,COMPOSITION,15K,10 PCT,1W	RC32GF153K	AU	1
R553 AND R554	SAME AS R107			
R555	RESISTOR,VARIABLE,COMPOSITION,100K,20 PCT, 1/2W/POLARAD PART NO. B131658	X3538	DR	1
R556	RESISTOR,COMPOSITION,56K,10 PCT,2W	RC42GF563K	AU	1
R557	RESISTOR,COMPOSITION,820K,10 PCT,1/2W	RC20GF824K	AU	1
R558	SAME AS R546			
R559	RESISTOR,COMPOSITION,33K,5 PCT,2W	RC42GF333J	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R560	NOT USED			
R561	RESISTOR,COMPOSITION,3K,5 PCT,1/2W	RC20GF302J	AU	1
R562	RESISTOR,COMPOSITION,91K,5 PCT,1/2W	RC20GF913J	AU	1
R563	SAME AS R113			
R564	RESISTOR,COMPOSITION,180K,5 PCT,1/2W	RC20GF184J	AU	1
R565	RESISTOR,COMPOSITION,8.2K,5 PCT,1/2W	RC20GF822J	AU	1
R566	RESISTOR,COMPOSITION,330K,5 PCT,1/2W	RC20GF334J	AU	1
R567	RESISTOR,COMPOSITION,13K,5 PCT,1/2W	RC20GF133J	AU	1
R568	RESISTOR,COMPOSITION,750K,5 PCT,1/2W	RC20GF754J	AU	1
R569	RESISTOR,COMPOSITION,22K,5 PCT,1/2W	RC20GF223J	AU	1
R570	NOT USED			
R571	RESISTOR,COMPOSITION,1.8 MEGO,5 PCT,1/2W	RC20GF185J	AU	1
R572	RESISTOR,COMPOSITION,20K,5 PCT,1/2W	RC20GF203J	AU	1
R573	RESISTOR,COMPOSITION,3.3 MEGO,5 PCT,1/2W	RC20GF335J	AU	1
R574	SAME AS R546			
R575 AND R576	RESISTOR,COMPOSITION,39K,10 PCT,2W	RC42GF393K	AU	1
R577 AND R578	RESISTOR,COMPOSITION,680 OHMS,10 PCT,1W	RC32GF681K	AU	1
R579	RESISTOR,COMPSITION,15K,10 PCT,2W	RC42GF153K	AU	1
R580	NOT USED			
R581	SAME AS R106			
R582	RESISTOR,COMPOSITION,270K,5 PCT,1/2W	RC20GF274J	AU	1
R583	RESISTOR,VARIABLE,COMPOSITION,DUAL CONC, SECT A,50K,SECT B,5K,20 PCT,2W,BOTH SECT	A133087	BE	1
R584	SAME AS R566			
R585	RESISTOR,VARIABLE,COMPOSITION,250K,20 PCT, 1/2W/POLARAD PART NO. B131659	X3539	DR	1
R586	RESISTOR,VARIABLE,COMPOSITION,DUAL SECT, SECT A,25K,SECT B,1K,20 PCT,1/2W,BOTH SECT /POLARAD PART NO. A702166	C2-35	DR	1
R587	SAME AS R555			
R588	SAME AS R201			
R589	RESISTOR,VARIABLE,COMPOSITION,500K,10 PCT,2W	A129113	BE	1
R590	NOT USED			
R591	RESISTOR,VARIABLE,COMPOSITION,1 MEGO, 20 PCT,2W/POLARAD PART NO. 517918	RV4NAYSB105B	AU	1
R592 THRU R594	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R595	SAME AS R559			
R596	SAME AS R502			
R597	SAME AS R107			
R598	NOT USED			
R599	SAME AS R573			
R601	RESISTOR,COMPOSITION,1.2 MEGO,10 PCT,1/2W	RC20GF125K	AU	1
R602	SAME AS R535			
R603 AND R604	RESISTOR,COMPOSITION,33K,10 PCT,2W	RC42GF333K	AU	1
R605	SAME AS R502			
R606	RESISTOR,COMPOSITION,47K,10 PCT,1W	RC32GF473K	AU	1
R607 AND R608	SAME AS R603			
R609	SAME AS R403			
R610	NOT USED			
R611	RESISTOR,COMPOSITION,68K,10 PCT,1W	RC32GF683K	AU	1
R612	SAME AS R556			
R613	RESISTOR,WW,25K,5 PCT,10W	10KT-25K	BN	1
R614	SAME AS R107			
R615 AND R616	SAME AS R502			
R617	RESISTOR,COMPOSITION,47 OHMS,10 PCT,1W	RC32GF470K	AU	1
R618	SAME AS R502			
R619	SAME AS R617			
R620 AND R621	NOT USED			
R622	SAME AS R502			
R623	NOT USED			
R624	SAME AS R535			
R625	SAME AS R503			
R626	RESISTOR,COMPOSITION,100K,10 PCT,1W	RC32GF104K	AU	1
R627	RESISTOR,VARIABLE,COMPOSITION,10K,10 PCT,2W /POLARAD PART NO. 517849	RV4NAYSD103A	AU	1
R628	RESISTOR,COMPOSITION,43K,5 PCT,1/2W	RC20GF433J	AU	1
R629	SAME AS R502			
R630 AND R631	NOT USED			
R632	RESISTOR,COMPOSITION,430K,10 PCT,1/2W	RC20GF434K	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R633	SAME AS R502			
R634	SAME AS R606			
R635	NOT USED			
R636	SAME AS R606			
R637	RESISTOR,COMPOSITION,220K,10 PCT,2W	RC42GF224K	AU	1
R638	RESISTOR,VARIABLE,COMPOSITION,25K,10 PCT,2W /POLARAD PART NO. 517851	RV4NAYSD253A	AU	1
R639	RESISTOR,COMPOSITION,75K,10 PCT,1/2W	RC20GF753K	AU	1
R640	NOT USED			
R641	SAME AS R617			
R642	NOT USED			
R643 THRU R645	SAME AS R617			
R646	RESISTOR,VARIABLE,WW,10 OHMS,10 PCT,5W	A129119	BE	1
R647	NOT USED			
R648	RESISTOR,COMPOSITION,330 OHMS,10 PCT,2W	RC42GF331K	AU	1
R649	RESISTOR,COMPOSITION,27K,10 PCT,2W	RC42GF273K	AU	1
R650	NOT USED			
R651	SAME AS R425			
R652	SAME AS R107			
R653	SAME AS R412			
R654 AND R655	RESISTOR,COMPOSITION,2.7 OHMS,5 PCT,1W	RC32GF2R7J	AU	1
R656	SAME AS R544			
R657	SAME AS R502			
R658	SAME AS R405			
R659	RESISTOR,VARIABLE,COMPOSITION,100K,10 PCT,2W /POLARAD PART NO. 517923	RV4NAYSD104A	AU	1
R660	NOT USED			
R661	RESISTOR,WW,50 MEGO,15 PCT,2W	BBM50MEG15PCT	CZ	1
R662	RESISTOR,VARIABLE,COMPOSITION,500K,10 PCT,2W /POLARAD PART NO. 517927	RV4NAYSD504A	AU	1
R663	RESISTOR,VARIABLE,COMPOSITION,500K,10 PCT,2W /POLARAD PART NO. 517916	RV4NAYSB504A	AU	1
R664	SAME AS R405			
R665	RESISTOR,COMPOSITION,3.9 MEGO,10 PCT,1W	RC32GF395K	AU	1
R666	NOT USED			
R667	RESISTOR,VARIABLE,COMPOSITION,5 MEGO, 20 PCT,2W/POLARAD PART NO. 517922	RV4NAYSB505B	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R668	NOT USED			
R669	SAME AS R665			
R670	NOT USED			
R671	SAME AS R665			
R672	RESISTOR•COMPOSITION•1•5 MEGO•10 PCT•1/2W	RC20GF155K	AU	1
R673 AND R674	NOT USED			
R675	RESISTOR•COMPOSITION•0•1K•5 PCT•1W	RC32GF101J	AU	1
R676 AND R677	RESISTOR•WW•1 OHM•5 PCT•5W	5F1	DB	1
R678 AND R679	RESISTOR•COMPOSITION•68 OHMS•10 PCT•2W	RC42GF680K	AU	1
R680 THRU R689	NOT USED			
R690	RESISTOR•WW•1K•5W/POLARAD PART NO• B707534/ USED ON MODEL SA-84WAF ONLY	57E1025T8	BN	1
R701 THRU R703	SAME AS R126			
R704	SAME AS R412			
R705	RESISTOR•COMPOSITION•68 OHMS•10 PCT•1/2W	RC20GF680K	AU	1
R706	SAME AS R412			
R707	RESISTOR•COMPOSITION•560 OHMS•10 PCT•1/2W	RC20GF561K	AU	1
R708	SAME AS R117			
R709 AND R710	SAME AS R204			
R711	SAME AS R205			
R712 THRU R716	SAME AS R204			
R717	SAME AS R117			
R718 AND R719	SAME AS R204			
R720	RESISTOR•COMPOSITION•330 OHMS•10 PCT•1/2W	RC20GF331K	AU	1
R721	SAME AS R205			
R722	SAME AS R422			
R801	SAME AS R107			
R802 AND R803	SAME AS R204			
R804	RESISTOR•VARIABLE•COMPOSITION• DUAL SECT•25K•10 PCT•1/2W•BOTH SECT /POLARAD PART NO• A706986	KR8822	DR	1
R805 AND R806	SAME AS R204			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R807	NOT USED			
R808	SAME AS R126			
R809	SAME AS R202			
R810	SAME AS R204			
R811	NOT USED			
R812 AND R813	RESISTOR,COMPOSITION,33 OHMS,5 PCT,1/2W	RC20GF330J	AU	1
R814 THRU R850	NOT USED			
R851	RESISTOR,COMPOSITION,3.6K,5 PCT,1/4W	RC07GF362J	AU	1
R852	RESISTOR,COMPOSITION,360 OHMS,5 PCT,1/4W	RC07GF361J	AU	1
R853	RESISTOR,COMPOSITION,5.6K,5 PCT,1/4W	RC07GF562J	AU	1
R854	RESISTOR,COMPOSITION,560 OHMS,5 PCT,1/4W	RC07GF561J	AU	1
R855	RESISTOR,COMPOSITION,300 OHMS,5 PCT,1/4W	RC07GF301J	AU	1
R856	RESISTOR,COMPOSITION,18 OHMS,5 PCT,1/4W	RC07GF180J	AU	1
R857	SAME AS R855			
S101	SWITCH,ROTARY,2 POLES,6 POSITIONS /POLARAD PART NO. A147851	PA2003	P	1
S102	SWITCH,ROTARY,5 POLES,10 POSITIONS /POLARAD PART NO. B707916	PA024-5082	P	1
S201 THRU S274	NOT USED			
S275 THRU S279	SWITCH,TOGGLE,DPDT	8373K8	CD	1
S301	SWITCH,SENSITIVE,SPDT	AN3234-1	A	1
S501	SWITCH,ROTARY,SINGLE POLE,4 POSITIONS /POLARAD PART NO. B707026	PA024-4349	P	1
S502	SWITCH,ROTARY,4PDT, NON-REPLACEABLE PART OF A502			
S601	SAME AS S275			
S602	SWITCH,ROTARY,2 POLES,5 POSITIONS /POLARAD PART NO. A137213	MS20-1-6DT	AL	1
S603	SWITCH,ROTARY,SINGLE POLE,3 POSITIONS /POLARAD PART NO. B707028	PA024-4351	P	1
S604	SWITCH,ROTARY,4 POLES,5 POSITIONS /POLARAD PART NO. B707917	PA024-5083	P	1
TB101	TERMINAL BOARD,COMPONENT ASSY	B137687	BE	1
T201	TRANSFORMER,RF	A140024	BE	1
T301 THRU T350	NOT USED			
T351	TRANSFORMER	A128006	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
T401	TRANSFORMER,RF	A127657	BE	1
T601	TRANSFORMER,POWER/POLARAD PART NO. B707445	ST26448	BQ	1
T602	TRANSFORMER,POWER	B130992	BE	1
T603	TRANSFORMER,HIGH VOLTAGE /POLARAD PART NO. A21385	ST1334	BQ	1
T604	TRANSFORMER,FILAMENT/POLARAD PART NO. B702275	ST4764	BQ	1
T801	TRANSFORMER,RF	B141447	BE	1
T802	TRANSFORMER,RF	B142122	BE	1
T803 THRU T850	NOT USED			
T851	TRANSFORMER,IF,VARIABLE	B146105	BE	1
V101	ELECTRON TUBE	6BL6	CK	2
V102 AND V103	ELECTRON TUBE	6AF4A	CK	4
V201	ELECTRON TUBE	6AK5	CK	6
V202 AND V203	ELECTRON TUBE	6BE6	CK	4
V204 AND V205	ELECTRON TUBE	6AH6	CK	8
V301	ELECTRON TUBE	6AF4A	CK	4
V302 THRU V350	NOT USED			
V351	ELECTRON TUBE	12AT7	CK	8
V352	SAME AS V201			
V353	ELECTRON TUBE	5763	CQ	2
V354	SAME AS V351			
V355	ELECTRON TUBE	12AX7	CK	10
V401 AND V402	NOT USED			
V403	ELECTRON TUBE	6005	AU	2
V404	NOT USED			
V405 AND V406	ELECTRON TUBE	5718	CK	6
V407	NOT USED			
V408	SAME AS V201			
V409	SAME AS V405			
V501	ELECTRON TUBE	6AS6	CK	2
V502	SAME AS V351			
V503 THRU V505	ELECTRON TUBE	12AU7	CK	6

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
V506 AND V507	ELECTRON TUBE	6AN8	CK	4
V508 AND V509	SAME AS V204			
V601	ELECTRON TUBE	5R4GY	CK	2
V602	ELECTRON TUBE	6AR6	CK	4
V603	SAME AS V355			
V604 THRU V606	ELECTRON TUBE	0A2	CK	6
V607	ELECTRON TUBE	0B2	CK	2
V608 AND V609	ELECTRON TUBE	6080	CK	6
V610	NOT USED			
V611	SAME AS V608			
V612	SAME AS V355			
V613	ELECTRON TUBE	5881	CK	2
V614	SAME AS V355			
V615	ELECTRON TUBE	5651	CK	2
V616	SAME AS V602			
V617 AND V618	ELECTRON TUBE	1Z2	CK	4
V619	ELECTRON TUBE•CRT	5ADP7	CK	2
V620	SAME AS V355			
V701 THRU V704	ELECTRON TUBE	6922	DN	8
V801	SAME AS V351			
V802	ELECTRON TUBE	6AG5	CK	2
W1 THRU W79	NOT USED			
W80	CABLE ASSY	A135336	BE	1
W81 THRU W84	NOT USED			
W85	CABLE ASSY	A134776	BE	1
W86	CABLE ASSY	A134778	BE	1
W87	NOT USED			
W88	CABLE ASSY	A135337	BE	1
W89	CABLE ASSY	A135338	BE	1
W90	NOT USED			
W91	CABLE ASSY	A134774	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
W92	CABLE ASSY	A134777	BE	1
W93	CABLE ASSY	A134775	BE	1
W94	CABLE ASSY	A144936	BE	1
W95	CABLE ASSY	A134780	BE	1
W96	CABLE ASSY	A134781	BE	1
W97 AND W98	CABLE ASSY	A141444	BE	1
W101	CABLE ASSY	A147829	BE	1
W102	CABLE ASSY	A147830	BE	1
W103	CABLE ASSY	A147835	BE	1
W104	CABLE ASSY	A142972	BE	1
W105	CABLE ASSY	A142973	BE	1
W106	CABLE ASSY	A147833	BE	1
W107	CABLE ASSY	A147834	BE	1
W108	CABLE ASSY	A137237	BE	1
W109	CABLE ASSY	A137240	BE	1
W110	CABLE ASSY	A147831	BE	1
W111	CABLE ASSY	A147832	BE	1
XCR601	CRYSTAL HOLDER,PART OF A602	UG-119A/UP	AU	1
XDS101 THRU XDS104	LAMPHOLDER,BAYONET SOCKET /POLARAD PART NO. A707152	2-24XP12	GR	1
XDS601	NOT USED			
XDS602	LAMPHOLDER,BAYONET SOCKET	101-3830-971	V	1
XDS603 THRU XDS606	LAMPHOLDER,BAYONET BASE	A17672	BE	1
Y201	CRYSTAL,QUARTZ,29MC,0.005 PCT	CR-23/U-29MC	AU	1
Y301 THRU Y350	NOT USED			
Y351	CRYSTAL,QUARTZ,50MC,0.005 PCT	CR-23/U-50MC	AU	1
Y352	CRYSTAL,QUARTZ,10MC,0.005 PCT	CR-23/U-10MC	AU	1
Y801 AND Y802	CRYSTAL,QUARTZ,6MC,0.005 PCT,	B706956	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	SUPPLIED ACCESSORIES			
A901	ACCESSORY KIT	A139059	BE	1
A902	WRENCH KIT	A25109	BE	1
CP902	WAVEGUIDE ADAPTER ASSY,Q BAND	A147738	BE	1
CP903	WAVEGUIDE ADAPTER ASSY,KU BAND	A147737	BE	1
CP904	WAVEGUIDE ADAPTER ASSY,K BAND	A147736	BE	1
CP905	WAVEGUIDE ADAPTER ASSY,KA BAND	A147739	BE	1
MP901	FILTER,CRT,YELLOW/POLARAD PART NO. B708101	100235	AK	1
P901 THRU P904	CONNECTOR,PLUG,MALE,N TYPE	UG-21D/U	AU	1
P905	CONNECTOR,ADAPTER,3 CONTACTS,PART OF W901 /POLARAD PART NO. A131966	228-BLK	FS	1
W901	POWER CORD ASSY,WITH ADAPTER	B111144	BE	1
W901A	CABLE ASSY,PART OF W901	B145871	BE	1
W902	CABLE ASSY	A109816	BE	1
W903	CABLE ASSY	A109817	BE	1
	OPTIONAL ACCESSORIES			
AT901	ATTENUATOR,KU BAND	AT-KU	BE	1
AT902	ATTENUATOR,K BAND	AT-K	BE	1
AT903	ATTENUATOR,KA BANK	AT-KA	BE	1
MP902	BRACKET,RACK MOUNTING,LEFT SIDE	D108774	BE	1
MP902A	BRACKET,RACK MOUNTING,RIGHT SIDE	D108775	BE	1
MP903	INSTRUMENT DOLLY	DA-4	BE	1

POLARAD

POLARAD ELECTRONIC INSTRUMENTS

A DIVISION OF POLARAD ELECTRONICS CORPORATION

34-02 QUEENS BOULEVARD · LONG ISLAND CITY 1, N.Y. · AREA CODE 212 · EXETER 2-4500

REQUEST FOR MAINTENANCE

FROM:

COMPANY NAME _____ DATE: _____

ADDRESS: _____ INDIVIDUAL _____

_____ POSITION _____

SECTION OR DIVISION _____ PHONE NO. _____ EXT. _____

EQUIPMENT _____ DATE OF PURCHASE _____

MODEL _____ SERIAL NO. _____ ORDER NO. _____

TROUBLE REPORT:

A. Description of trouble _____

B. Has trouble been localized? _____ If so, how and where: _____

C. Instruments used and measurements taken, if any: _____

_____

_____

_____

D. Is trouble intermittent? _____

E. Hours of operation prior to this trouble _____

F. Date trouble occurred _____

G. Was factory consulted by telephone or letter prior to this request? _____

If so, give date and person to whom directed: _____

_____

H. Additional Comments: _____

_____

_____

_____

_____

_____

_____

When trouble develops requiring factory assistance, complete this form and send to:

Polarad Electronic Instruments
Division of
Polarad Electronics Corporation
34-02 Queens Boulevard
Long Island City 1, New York
ATTENTION: Service Department

After this report has been analyzed by the Service Department, you will be notified when a field service engineer will call on you to make the necessary repairs. If your trouble can best be corrected at the factory, we will so notify you with instructions and authorization for returning the equipment.

NO EQUIPMENT MAY BE RETURNED TO THE FACTORY WITHOUT WRITTEN AUTHORIZATION

Microwave Electronic Instruments

POLARAD

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Spectrum Analyzers 10 — 100,000 mc . . . . . 2 — 3
Spectrum Signature Monitors 400 — 84,200 mc 4
Microwave Receivers 400 — 84,200 mc . . . . . 4 — 5
RI/FI Meters 1,000 — 21,000 mc; Antennas . . . . . 4 — 5
Signal Generators & Signal Sources 500 — 50,000 mc 6
Modular Microwave Signal Generator Equipment 7
Pulse, Impulse, and Noise Generators; Infrared; Related Instrumentation 7
Industry Services 8

POLARAD ELECTRONIC INSTRUMENTS A Division of Polarad Electronics Corp. 34-02 Queens Blvd., Long Island City 1, New York
World Leader in Microwave Instrumentation

POLARAD SPECTRUM ANALYZERS PROVIDE PRECIS

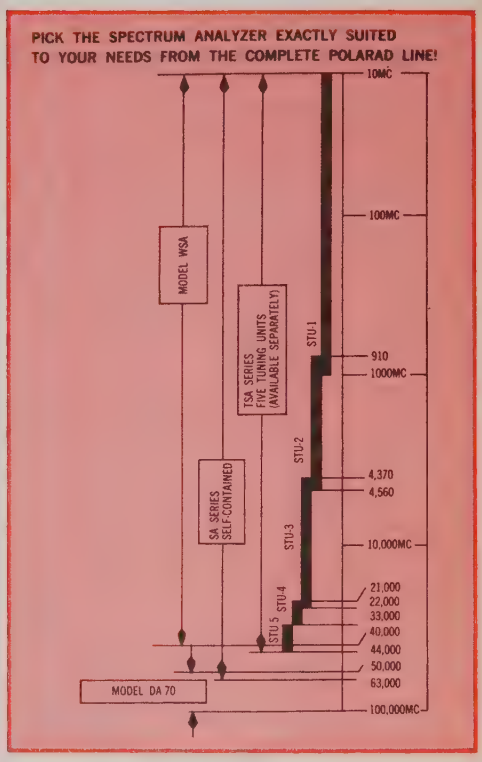
Polarad pioneered the modern microwave spectrum analyzer. Today, this diversified line of instruments provides the designer or test engineer with the most precise and meaningful quantitative and qualitative information about any signal, regardless of complexity or frequency content, up to 100 KMC.

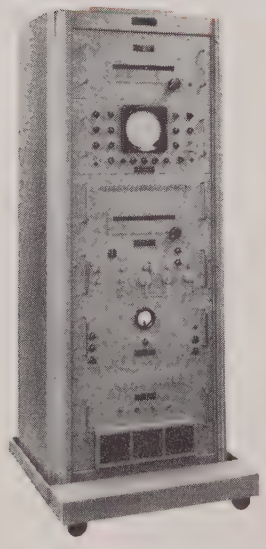
The unequalled dependability, accuracy, and operational convenience provided by these instruments reflect the experience and design ability that have made Polarad the undisputed leader in this demanding form of the microwave instrumentation art.

The features listed below are, in general, common to all Polarad Spectrum Analyzers.

- **Direct-reading UNIDIAL® tuning — no klystron mode-setting!**
- **Frequency Dial Accuracy, ±1%**
- **Sweep-rate adjustable, 1-30 cps**
- **High Sensitivity**
- **Variable resolution for optimum analysis.**
- **Non-contacting klystron-cavity chokes for noiseless tuning, optimum stability**
- **Five-inch flat-face CRT display**
- **Compatible with Multi-pulse Spectrum Selector SD-1**
- **Low residual FM**

The chart to the right permits rapid selection of the spectrum analyzer best suited to your problem. Note that by taking advantage of the plug-in range selection of the TSA series, you need only purchase the range you need, yet you automatically provide for extending the range later by obtaining additional tuning units as required!





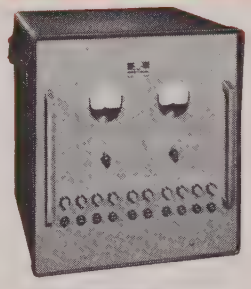
Model WSA

WIDE BAND SPECTRUM ANALYZER 10 - 40,000 MC

Model WSA is a unique universal instrument providing the ultimate in convenience and application flexibility.

Features: rapid range selection by 20 illuminated push-buttons; wide band display—up to 4,000 MC—simplifying field-intensity measurements; end-markers, indicating band limits; frequency marker to 4KMC; Narrow mode: 1-25MC dispersion, 20KC resolution; Wide mode: 50-4,000 MC dispersion, 1.5MC resolution; center marker for wide-to-narrow band switching without loss of signal.

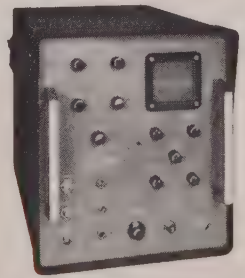
Frequency Range	Nominal Sensitivity
10 mc to 410 mc	—80 dbm
410 mc to 12.4 kmc	—70 dbm
12.4 kmc to 18.5 kmc	—60 dbm
18.5 kmc to 26.0 kmc	—50 dbm
26.0 kmc to 40.0 kmc	—50 dbm



Model DA-70

EHF SPECTRUM ANALYZER

Model DA-70 covers the important range from 50-100 KMC, using a single accurately-calibrated (±1%) tuning unit with exclusive UNIDIAL® convenience. Dispersion is continuously adjustable from 50-1,000MC; Resolution is 1MC. Markers are provided for spectrum calibration to ±5%. High-frequency IF stages insure excellent image rejection, prevent video detection. Sensitivity, —50 dbm, nominal.



Model SD-1

MULTIPULSE SPECTRUM SELECTOR Model SD-1

When used in conjunction with any Polarad spectrum analyzer, this unique instrument permits spectrum analysis of any one selected pulse within a multiple pulse train. Particularly useful in design and analysis of telemetry, IFF, beacons, and radars.

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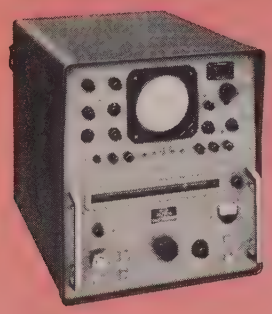
VISUAL MICROWAVE ANALYSIS — 10 to 100,000 MC

POLARAD

SA SERIES

Universal Spectrum Analyzers represent the most advanced designs in the current state of the art. Completely self-contained, with every important marker, control, and calibration facility normally required in spectrum analysis, they cover their entire frequency range without plug-ins or accessories. In particular the new Model SA-84WA provides the widest frequency range ever offered in a universal instrument: 10 MC to 63,680 MC! Also of special interest is the new portable, compact transistorized Model SA-84T . . . 40% lighter, with improved performance.



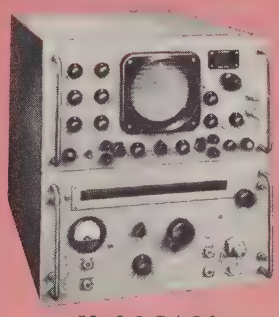
Model SA-84W/WA

Sensitivity to —115 dbm

Wide-Dispersion Universal Design. **Features:** excellent sensitivity; wide-range variable dispersion; wide-range variable resolution; crystal-controlled markers over entire frequency range; log-linear display; accurate IF attenuator.

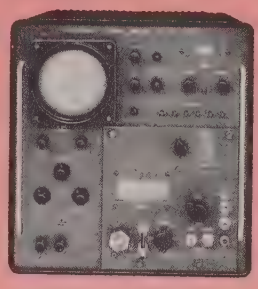
Model	Frequency	Dispersion	Resolution
SA-84WA	10-63,680MC	25KC-80MC (Available to 100MC)	1KC-80KC
SA-84W	10-40,880MC	25KC-80MC*	1KC-80KC

*25KC-10MC below 240MC.



Model SA-84

Standard Universal design, 10-40,880 MC. **Features:** excellent sensitivity (—40 to —90 dbm, depending on frequency); Variable internal marker, graduations every 200 KC; 25 KC resolution; dispersion adjustable 500 KC — 25 MC (500 KC — 5 MC up to 55 MC). The most economical universal instrument in its class!



Model SA-84T

Portable Transistorized Universal design, 10-40,880 MC. **Features:** excellent sensitivity (—55 to —105 dbm, depending on frequency); ±13 MC internal marker tuning range; 20 KC resolution; dispersion adjustable 500 KC — 25 MC. Operates from 12 volt battery or line power. Truly portable!

TSA SERIES

Spectrum Analyzers can all cover 10-44,000 MC, the actual range being determined by the number of interchangeable plug-in tuning heads purchased. Thus, the engineer may select only the ranges of interest, yet provide for full coverage at some later date, reducing his initial investment.

The basic TSA design is available in three forms: with a conventional variable dispersion, with a wider range of dispersion, and with a built-in synchroscope mode.

TSA/TSA-S	TSA-W	Equipment	Frequency Range	Sensitivity: (minimum discernible signal)
STU-1B	STU-1BW	R-F Tuning Unit	10 to 1,000 mc	10 to 400 mcs —90 to —105dbm 350 to 1,000 mcs —88 to — 95dbm
STU-2B	STU-2BW	R-F Tuning Unit	910 to 4,560 mc	910 to 2,200 mcs —100to —115dbm 1,980 to 4,560 mcs —100to —110dbm
STU-3B	STU-3BW	R-F Tuning Unit	4,370 to 22,000 mc	4,370 to 11,000 mcs —77 to —90 dbm 8,900 to 22,000 mcs —65 to —85 dbm
STU-4B	STU-4BW	R-F Tuning Unit	21,000 to 33,000 mc	21,000 to 33,000 mcs —57 to —75 dbm
STU-5B	STU-5BW	R-F Tuning Unit	33,000 to 44,000 mc	33,000 to 44,000 mcs —50 to —65 dbm

OPTIONS

1. 100 mc Dispersion
2. Phase Lock Capability
3. AM Marker Modulation Input
4. XY Recorder Output & Slow Scan Rate
5. 50 DB on Screen Log Display
6. 63 DB Calibrated IF Attenuator
7. Choice of CRT Phosphor

UNIT

1. TSA-W, SA-84W, SA-84WA
2. All Units
3. All Units
4. TSA, TSA-W, SA-84W, SA-84WA
5. TSA, TSA-W, SA-84W, SA-84WA
6. SA-84T
7. All Units

Model TSA

Provides power vs. frequency display. **Features:** adjustable dispersion, 100 KC — 25 MC; variable resolution, 1-80 KC; ±14 MC marker tuning range; excellent sensitivity (—50 to —115 dbm, depending on frequency); log-amplitude display for wide dynamic range.

Model TSA-W

Provides widest range of dispersions. Shown above are two displays representing extremes of adjustable dispersion range (25 KC — 80 MC). Resolution variable, 1 — 80 KC. ±40 MC marker tuning range. Excellent sensitivity (—50 to —115 dbm, depending on frequency). This instrument will display the spectrum of a 0.1 μsec. pulse!

Model TSA-S

Combines high-performance Synchroscope display (shown above left) with conventional power-vs.-frequency display. Synchroscope sweep rates adjustable from 2μsec/trace to 0.1 sec/trace. Dispersion adjustable, 400 KC —25 MC. Resolution 5/50/500 KC and 5 MC. Marker tuning range, ±14 MC. An excellent dual-purpose research instrument!

POLARAD MICROWAVE RECEIVERS (400-84,200 MC)

Polarad developed many of the fundamental circuit concepts upon which most of the calibrated microwave receivers and field-intensity meters in current use are based. The four instrumentation systems described on these 2 pages represent the highest achievements in the current state of the art.

Among the outstanding features of these instruments are the following:

- Direct-reading ±1% frequency calibration, with digital display and/or UNIDIAL® tuning.
- Complete flexibility of signal reception: AM, FM, CW, Pulse.
- Direct and absolute signal-level calibration — with internal calibrating generators in the RI/FI meters.
- Complete range of compatible calibrated and uncalibrated antennas with exceptional directivity and low VSWR.

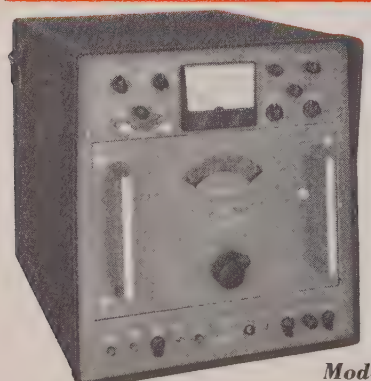
TRANSISTORIZED MICROWAVE RECEIVER

0.95-21 KMC. **Portable, compact, rugged.** Four instruments in one: AM, FM, CW, MCW, Receiver; Pulse Receiver; Field-Intensity Receiver, and sensitive Power Meter.

Model TR

- **AFC, AGC circuits.**
- **Digital frequency dial.**
- **60 db linearity range!**
- **Impulse Bandwidth: 1 MC, 5 MC, or wideband.**
- **Output calibrated directly in db.**
- **Preselection on all tuning units.**
- **Video Bandwidth, 4 MC.**
- **Sensitivity: —77 dbm minimum.**
- **Choice of 12V battery or line power.**
- **Audio, video, recorder outputs.**

Six Interchangeable Plug-In Tuning Units		
Tuning Unit No.	Frequency Range	Minimum Sensitivity
T-RL	950 — 2,040 mc	— 90 dbm
T-RS	1,900 — 4,340 mc	— 90 dbm
T-RM	4,200 — 7,740 mc	— 87 dbm
T-RX	7,300 — 11,260 mc	— 87 dbm
T-RKS	9,850 — 15,350 mc	— 80 dbm
T-RKU	14,800 — 21,000 mc	— 77 dbm



ULTRA-WIDE-BAND MICROWAVE RECEIVER

0.4-84.2 KMC! Choose only the tuning ranges you require, yet provide for full coverage later — thus effecting significant saving in initial investment! Four instruments in one: AM, FM, CW, MCW, Receiver; Pulse Receiver; Field Intensity Receiver, sensitive Power Meter.

Model R

- **AFC, AGC circuits.**
- **Direct-reading UNIDIAL®.**
- **60 db linearity range!**
- **Image and Spurious Response rejection better than 60 db up to 11.26 KMC.**
- **Video Bandwidth, 2 MC.**
- **Sensitivity: —85 to — 55 dbm (minimum), depending on frequency range.**
- **Output calibrated directly in db.**
- **Audio, video, recorder outputs.**

Ten Interchangeable Plug-In Tuning Units:		
Tuning Unit	Frequency Range	Minimum Sensitivity
Model RR-T	395 to 1,050 mc	—85 dbm
Model RL-T	950 to 2,040 mc	—80 dbm
Model RS-T	1,900 to 4,340 mc	—80 dbm
Model RM-T	4,200 to 7,740 mc	—80 dbm
Model RX-T	7,300 to 11,260 mc	—80 dbm
Model RKS-T	9,500 to 15,600 mc	—65 dbm
Model RKU-T	14,700 to 22,000 mc	—65 dbm
Model RQ-T	20,260 to 31,260 mc	—65 dbm
	30,260 to 46,700 mc	—55 dbm
Model RE-T	45,300 to 84,200 mc	—55 dbm
Model RW-T*	2,000 to 75,000 mc	—70 to —85 dbm

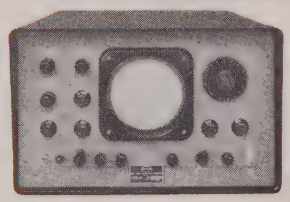
*Antenna Pattern Tuning Unit. External mixer with flexible cable. Locate up to 75 ft. from receiver, at or near antenna.

MICROWAVE TEST ANTENNAS

Calibrated (MIL-I-26600 approved) and uncalibrated types. Highly directional, linearly polarized, high front/back ratio, max VSWR of 3:1. Lightweight, portable, rugged construction.

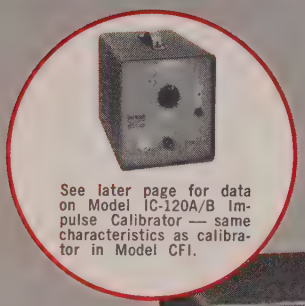
CALIBRATED TEST ANTENNAS		TEST ANTENNAS	
Model	Frequency Range	Model	Frequency Range
CA-B	1,000 to 10,000 MC	UH1	400 to 1,000 MC
CA-L	1,000 to 2,340 MC	L	1,000 to 2,300 MC
CA-S	2,140 to 4,340 MC	S	2,150 to 4,600 MC
CA-M	4,190 to 7,740 MC	M	4,450 to 8,000 MC
CA-X	7,360 to 10,000 MC	X	7,850 to 12,400 MC
CA-KS	9,800 to 15,350 MC	Ku	12,400 to 18,000 MC
CA-KU	14,750 to 21,000 MC	K	18,000 to 26,500 MC
CA-KSO	9,850 to 15,350 MC	Ka	26,500 to 40,000 MC
CA-KUO	14,750 to 21,000 MC		
CA-T	Tripod		

SPECTRUM SIGNATURE MONITOR MODEL DM-1



Converts your Receiver or RI/FI Meter for Visual Display of Signal Power vs Frequency

Model DM-1 utilizes 140-megacycle IF output of receiver or meter to provide linear or logarithmic display of signal amplitude versus frequency-components, on 5-inch CRT. Variable resolution 1-80 KC, adjustable dispersion 150 KC-25MC, attenuation from 0-40 db, and calibrated marker pips variable ±14 MC, permit meaningful signal analysis over the receiver's frequency range. An efficient, economical way to add a Spectrum Analyzer to your lab or field instrumentation!



See later page for data on Model IC-120A/B Impulse Calibrator — same characteristics as calibrator in Model CFI.

TRANSISTORIZED CALIBRATED FIELD-INTENSITY (RI/FI) METER — 1,000 to 15,000 MC.

USAF approved RI/FI measurements to 10KMC per Category A of MIL-I-26600 and MIL-I-6181!

Transistorized, portable, compact, ruggedized.

Combines an impulse calibrator, field-intensity meter, and calibrated antenna system. Provides accurate measurements of frequency and absolute power level of conducted or radiated microwave energy. Choice of 12V battery or line-power operation.

Features: UNIDIAL® tuning; Direct-reading **digital** frequency dial; ±1% frequency accuracy; Choice of 3 impulse bandwidths — 1/5/wideband MC; output level direct-reading in db; Image and spurious response rejection better than 60 db; Max. RF input, 3 volts. Audio, video, recorder outputs. AM, FM, CW, and Pulse reception.

Model CFI

Five Interchangeable Plug-In Tuning Units		
Tuning Unit No.	Frequency Range	Minimum Sensitivity
CFI-L	1,000 — 2,040 mc	—90 dbm
CFI-S	1,900 — 4,340 mc	—90 dbm
CFI-M	4,200 — 7,740 mc	—86 dbm
CFI-X	7,300 — 10,000 mc	—85 dbm
CFI-KS	9,850 — 15,000 mc	—80 dbm

All Polarad RI/FI systems are furnished with the appropriate calibrated antennas, per MIL-I-26600

CALIBRATED MICROWAVE FIELD-INTENSITY (RI/FI) METER — 1,000 to 21,000 MC!

Full Category A Air-Force Approval Per MIL-I-26600 and MIL-I-6181 to 10 KMC!

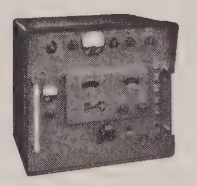
Widest range ever offered in a microwave RI/FI meter!
Combines internal signal generator, field-intensity meter, and calibrated antenna system. Provides accurate absolute power level and frequency measurements. The signal level indication is in microvolts, db above 1 microvolt, and db above 1 microvolt per megacycle.

Model FIM-2

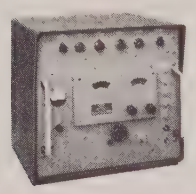
- **Only microwave Field Intensity Receiver with self-contained signal generator which calibrates entire system under test at any level.**
- **First single microwave test system to determine radiated r-f interference and susceptibility.**
- **Front-panel meter indicates average, peak, slide-back peak or quasi-peak value of r-f signals. Outputs for video, audio and recorder.**
- **Six interchangeable tuning heads cover 1,000 to 21,000 mc.**
- **Direct-indicating peak VTVM for ease of frequency location of impulse noise.**
- **Single UNIDIAL® tuning control tunes both the receiver and signal generator.**
- **Calibrated antenna system includes an omni-directional broadband antenna and separate directional antennas to match each tuning unit.**
- **Frequency Dial Accuracy: ±1%**
- **Maximum RF Input: 3 volts**
- **Impulse Bandwidth: 5 mc**
- **Image and Spurious Response Rejection: Better than 60 db**
- **Attenuation: 0 to 80 db in steps of 1 db**

Six Interchangeable Plug-In Tuning Units†:		
Tuning Unit No.	Frequency Range	Minimum Sensitivity
FIM-L2	1,000 to 2,240 mc	—81 dbm
FIM-S2	2,140 to 4,340 mc	—81 dbm
FIM-M2	4,200 to 7,740 mc	—81 dbm
FIM-X2	7,360 to 10,000 mc	—81 dbm
FIM-KS	9,850 to 15,350 mc	—73 dbm
FIM-KU	14,800 to 21,000 mc	—70 dbm

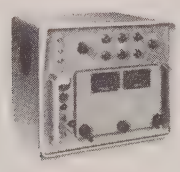
†U.S. Patent 2,774,243



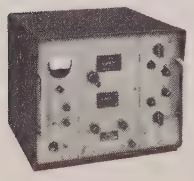
Model PMR



Model MSG-1R/2R/2PA



Model PMX



Model MSG-34

Model KSS

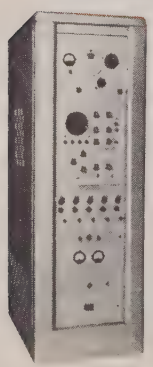
Polarad signal generators and sources incorporate every significant mechanical and electronic advancement known to the art, including a number of Polarad exclusives. These instruments are used by the thousand in every phase of microwave development and measurement. They are widely used in permanent test consoles, because of their exceptional stability and reliability. In particular, experienced engineers appreciate the outstanding features listed here, which generally apply to all units in the line, with some variations.

- **Accurate frequency calibration — ±1%, except EHF ±0.1%**
- **DIRECT-reading UNIDIAL® (EHF has direct-reading wavemeter).**
- **Low thermal and power-line drift.**
- **Exceptional permanence of calibration.**
- **Extremely versatile modulation capabilities.**
- **Accurate, directly-calibrated attenuators.**
- **Generators all have accurate absolute power-level calibration.**

500-11,000 MC SERIES

Features include: High-stability, non-contacting klystron-cavity shorts for noiseless tuning, calibration permanence; UNIDIAL®; exceptionally complete modulation capability. The PMR is particularly notable for its precise, wide-range, low distortion FM capability, extremely valuable in microwave telemetry applications.

MODEL	FREQUENCY KMC	CALIBRATED POWER OUTPUT	INTERNAL MODULATION
PMR	0.5 - 1.0	−3 dbm (0.5 MW) to −127 dbm	FM: 100-100,000 cps, 0 to ±300 KC deviation. < 1% harmonic distortion.
MSG-1R	0.95 - 2.40	0 dbm (1 MW) to −127 dbm	All instruments in this group: pulse & FM modulation: 10-10,000 pps. *pulse width: 0.2-10 μsec. pulse delay: 2-2,000 μsec. square-wave modulation: 10-10,000 pps. FM deviation: ±2.5 MC min. *0.3-10 μsec. in MSG-1R and MSG-2PA
MSG-2R	2.0 - 4.60	0 dbm (1 MW) to −127 dbm	
MSG-2PA	2.4 - 4.0	+10 dbm (10 MW) to −127 dbm	
PMX	4.45 - 11.0 (2 plug-ins)	0 dbm (1 MW) to −127 dbm	
MSG-34 (Ultra Broadband)	4.2 - 11.0 digital freq. indicator	0 dbm (1 MW) to −127 dbm	
KSS (Signal Source)	1.05 - 11.0 (4 plug-ins)	Uncalibrated Power Output: 14-400 MW, depending on freq.	sq-wave, 10-10,000 pps (external pulse, sq-wave FM)



Model B

MULTI-PULSE CODE-MODULATED MICROWAVE SIGNAL GENERATOR

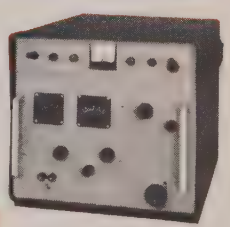
Provides microwave signals (0.95-10.75 KMC) modulated by coded pulse combinations, for testing and simulating IFF, radar, beacons, navigation systems, telemetry, communication links, missile guidance systems. Five independent pulse generators combine to produce complex modulation codes. (See description of MP-1A on opposite page for additional data on modulator.) Built-in precision 'scope.

Four Interchangeable Oscillators	
Tuning Unit	**Frequency Range**
BL-1	950 to 2,400 mc
BS-1	2,150 to 4,600 mc
BC-1	4,450 to 8,000 mc
BX-1	7,850 to 10,750 mc

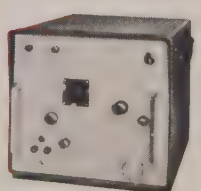
EXTREMELY HIGH FREQUENCY MICROWAVE SIGNAL GENERATORS & SOURCES

Generators are frequency and power calibrated, Sources are frequency calibrated only. CW, 1KC internal AM, or external modulation. High power output. See chart for plug-in tuning units. Also available: SG1218 (Generator) or SS1218 (Source) 12.4-17.5 KMC.

EHF SIGNAL GENERATOR Tuning Unit	Frequency Range	EHF SIGNAL SOURCE Tuning Unit
G1822-1	18,000 to 22,000 mc	S1822-1
G2225-1	22,000 to 25,000 mc	S2225-1
G2427-1	24,700 to 27,500 mc	S2427-1
G2730-1	27,270 to 30,000 mc	S2730-1
G3033-1	29,700 to 33,520 mc	S2933-1
G3336-1	33,520 to 36,250 mc	S3336-1
G3540-1	35,100 to 39,700 mc	S3540-1
	39,600 to 46,000 mc	S4046-1
	45,900 to 50,000 mc	S4650-1



Model EHF Generator



Model EHF Source

ND SOURCES

POLARAD

MODULAR MICROWAVE SIGNAL-GENERATOR COMPONENTS

3,800 TO 21,000 MC

Model 1809/10 Signal Generator

Latest addition to the Polarad line, this integrated group of seven elements offers the system designer a choice of 86 useful basic combinations for composing a precision signal reference source in the 3,800 to 21,000 megacycle range. These light, compact, self-powered elements can be mounted in your laboratory rack, or stacked in your field location. Any Generator or Source may be used alone, or with the appropriate Doubler; combinations of Generators and/or Sources may share the use of one or both Doublers, and the Modulator may be used as a common driver in all cases. From a single unit to the most elaborate console, all installations offer the same high standards of accuracy, stability, and reliability that characterize the Polarad line of microwave equipment.

SIGNAL GENERATORS

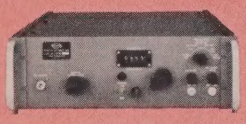
Model 1107 Model 1108

Featuring digital frequency readout with ±0.5% accuracy. VSWR of 2:1 maximum, internal modulation 800—1200 cps square wave, and 800—1200 cps FM sawtooth with continuously adjustable sweepwidth to ±5 MC from center frequency. Accepts external 1 cps to 1 MC pulse, square wave modulation and 100 cps — 500 KC frequency modulation.

Calibrated power output of 2 MW (+3 dbm) down to —127 dbm, with ±2 db absolute accuracy.

SIGNAL SOURCES

Model 1207 Model 1208



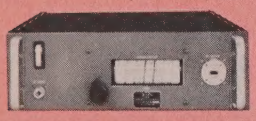
Features identical to signal generators above without calibrated output power.

Minimum power output Model 1207—50 MW. Model 1208—25 MW.

FREQUENCY DOUBLERS

Model 1509
Output: 10,000—15,500 MC
Input: 5,000—7,750 MC

Model 1510
Output: 15,000—21,000 MC
Input: 7,500—10,500 MC



Less than 18 db conversion loss; 250 MW max. input power, 2:1 max. VSWR. Calibrated power output of 1 MW (0 dbm), with frequency-insensitive attenuator, continuously variable from 0 to —100 dbm, calibrated directly in-dbm, accurate to ±2 db.

MODULATOR

Model 1001 Pulse Square Wave and Sawtooth FM

Designed to drive above generators and sources. 10-10,000 pps, positive 20-volt-peak output pulses, 0.2-10 microseconds wide, internal or external synchronization. 150-ohm output impedance permits driving up to 10 feet of interconnecting cable if necessary. Sync pulse output delivers 15-volt positive pulse, with adjustable delay up to 2000 microseconds.

Now! ELECTRO-OPTICAL INSTRUMENTATION!

. . . from TELEWAVE LABORATORIES, INC.

(a subsidiary of Polarad Electronics Corporation)

INFRA-PAK™

MODULAR COMPONENTS for the infrared, visible, and ultraviolet bands.

An integrated system of components for generating, processing, detecting and measuring radiation.

Already available: precision adjustable radiation sources, variable and fixed-frequency filters, variable-speed optical choppers, variable and step-attenuators, lens systems, calibrated detector-snychronous amplifier radiation monitors. More coming soon!

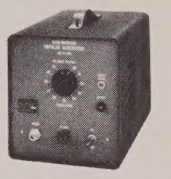
POLARAD MICROWAVE INSTRUMENTS & ACCESSORIES

TRANSISTORIZED MICROWAVE IMPULSE GENERATOR

WIDE-BAND: 1 MC to 10,000 MC, flat within ±0.5 db. Generates 0.02 nanosecond pulses!

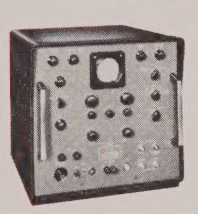
VERSATILE: Calibrates microwave receivers for RI/FI work. Ideal signal source for checking spectrum analyzers. Recommended for noise, bandwidth, and jamming measurements.

CONVENIENT: Choice of mobile battery or power line operation. Light and compact — truly portable. Output directly calibrated in db above 1 μvolt/MC bandwidth. Two power level ranges. Impulse level adjustable. Regulated power supplies.



Model IC-120A/B

PULSE JITTER TESTER



VERSATILE: Measures pulse-width jitter, repetition-rate jitter, and pulse-to-pulse jitter, displays envelope of jitter, permitting complete analysis and identification of disturbance frequency. Separate video and disturbance-freq. outputs.

WIDE-RANGE: Ranges from 5 nanoseconds to 100 μseconds full scale on absolute (prf) jitter, and 5-100 nanoseconds full scale on relative jitter. Resolves down to 0.5 nanoseconds accurately! Prf acceptable from 50-6,000 pps. Accepts 0.2-10 μsec width pulses, 5 to 50 volts amplitude, positive or negative.

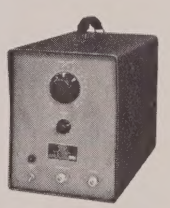
CODED MULTI-PULSE GENERATOR

Provides 5 identical, independently-adjustable (width and delay) plug-in pulse generators, each of which may be independently pulse-time-modulated by external signal. External or internal synch. Interval markers, every microsecond. Auxiliary output trigger at "zero time", output square wave coincident with pulse group. Extremely flexible pulse — group generator/modulator. High power output — up to 20 volts into 100Ω!

Model MP-1A

PRECISION NOISE GENERATOR

Stable 1 KC to 500 MC noise source for direct measurement of noise figure of vacuum-tube and transistor amplifiers, receivers. Direct-reading, accurately-calibrated 1-20 db output control (with 0-1 db interpolation control) ±0.25 db accuracy. Accommodates wide range of terminating impedances. Employs long-life, inexpensive noise tubes. Simple, accurate, trouble-free!



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ALL-CERAMIC REFLEX KLYSTRONS

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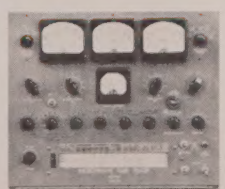

Model K-200

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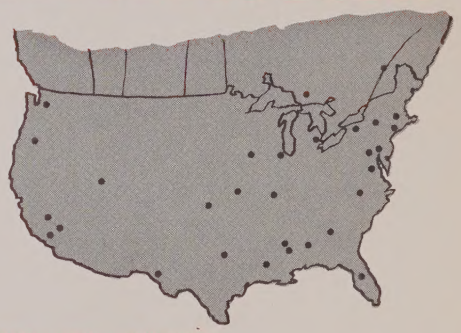

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